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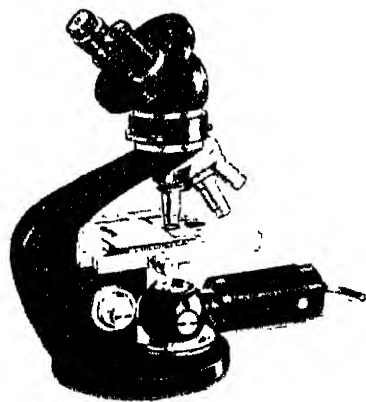
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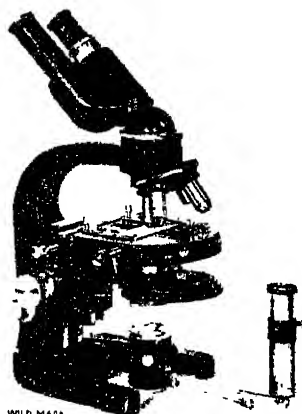
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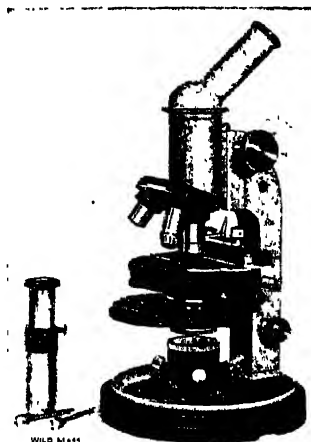
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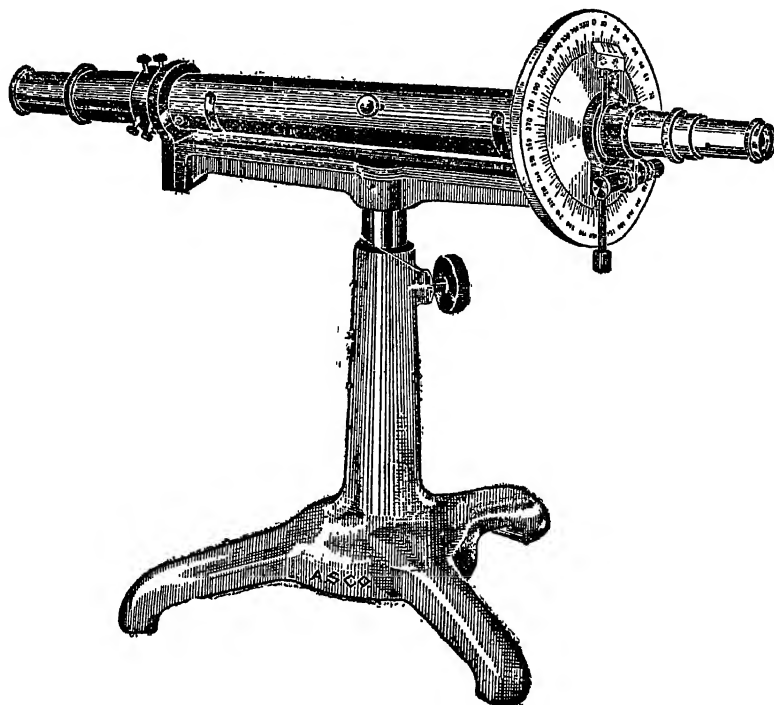
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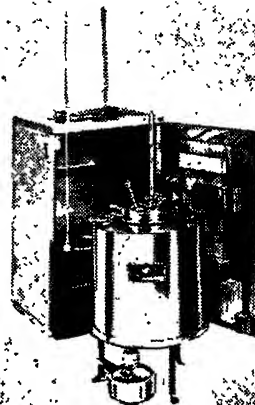
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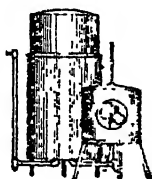
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# Current Science

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## WHY SOCIAL SCIENCES ?

IN the words of Professor Joad, "Until our social wisdom is able to cope with our mechanical skill and we learn to live up to the challenge of our new powers, the discoveries of science will tend to our discomfiture rather than to our good".<sup>1</sup> The above is obviously no exaggeration; for, while there is a large, consistent and continuous wave of scientific discoveries and technical inventions which any age could be proud of, there has also been apparently a serious lack of what Adler called *social interest*, with the result that the discrepancy between the ideals and realities of our social life is rather painful. With all the abundant possibilities for human comfort and happiness, it can scarcely be claimed that the modern man is finding life any the easier or happier. The promise of science to make man not only wiser and cleverer but also richer and happier is not only unfulfilled, but definite tendencies towards an opposite effect are discernible.

Clearly enough, this impasse may be attributed to what sociologists would call a 'cultural lag', i.e., some aspects of our life have changed more quickly than the others and this has resulted in an obvious imbalance and maladjustment. The rise of the mechanical philosophy which was till recent years very fashionable, no doubt stirred up vigorously our scientific activity and provided the attitude necessary for the growth of science. But in dogmatizing that "the objects of the scientists' real world have size, shape, motion, but there is no colour, scent, beauty in that world; there is no purpose, no emotion, no love",<sup>2</sup> it precluded human considerations altogether. It would appear that even when in the late 19th century man got interested in the working of his own mind and the science of psychology was born, it was more or less coloured by the same spirit.

Meanwhile, the social structure was changing rather rapidly. With the mounting of inventions and their increasing utilisation, life also

became more complicated; and this process is even now going on at a bewildering speed. This complexity in human life was a social phenomenon and the nineteenth century scientist was not interested in it. Matters came to a head when the political sovereigns directed scientists to apply their knowledge for maximum efficiency in war. The result was shocking; and so for the first time in the history of science, the scientist has begun to seriously concern himself about his obligations to society. The impact of science on society has since then become a matter for serious thinking and the tendency to-day is to harness the fruits of scientific research to the best advantage of both science and society. In this connection, MacIver has suggested that "with specialization and complexity, and the rapid tempo of change that accompany them, new attitudes are required, as a precondition to successful adjustment".<sup>3</sup> Obviously, this change in the attitude is not yet an accomplished fact.

The confusion prevailing to-day has been recognised to be largely due to the conspicuous absence of social sciences. In fact, Professor Joad complains that "our social sciences lag so far behind our physical and chemical sciences, that we are increasingly unable to distribute the goods we so abundantly produce".<sup>4</sup> Also, Herman Levy has pleaded for "sociological understanding, and power to control and guide the forces of society".<sup>5</sup> It is being increasingly felt that the man of science must know the science of man; and that he has a social obligation to discharge. As Professor P. W. Bridgman remarks "the subject is obviously so terribly important".<sup>6</sup>

Indeed, it is this recognition that has necessitated and encouraged the development of social sciences; for, social structure, motive, ideal, organisation, function and interaction all fall within the scope of these sciences. Society is a dynamic, living organism with peculiar modes of existence and with laws of its own. "The task of social science is to find guiding threads of principle through the infinite variety of processes and activities which make up social life."<sup>7</sup> They start and end, with "people, who

are many, in their social relations, which are manifold". Among the major branches of social sciences might be mentioned (a) psychology, the study of man's mind and behaviour, (b) economics, the study of man's material goods, (c) demography, the study of population changes, (d) anthropology, the study of 'primitive' societies, (e) sociology, the study of social relations and institutions, (f) politics, the study of governments, and (g) history. Each of these contributes its own share to the total study of man in society and how he came to be what he is. And as Professor Bridgman has shown,<sup>8</sup> the scientific methods of analysis and description are applicable to the study of man also—only the conditions here are not so easy to tackle.

Thus it becomes necessary for the 'pure' scientist to recognise that the study of social sciences is indispensable for an insight into the social implications so obviously involved in the subject of his study, and also to realise that such a study is almost of the same category as his own, and finally to appreciate that if 'pure' science is to have any survival value, it should come from social sciences. Indeed, what can be more desirable than that science must be pressed into the service of man, and that the ideal must be maximum happiness in the social and individual life of man? A suggestion cited by Sir Josiah Stamp "to co-operate scientific, social and industrial phases of invention, and to reduce the lag between invention and application"<sup>9</sup> thus deserves the careful consideration of every earnest thinker on whom devolves the responsibility for promoting the greatest welfare of the greatest number.

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S. K. RAMACHANDRA RAO.

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# THE ISOLATION OF THE 2,4-DINITROPHENYLHYDRAZONE OF 'GLUTAMIC ACID SEMIALDEHYDE' FROM THE ACID HYDROLYSATE OF PERIODATE-TREATED GELATIN

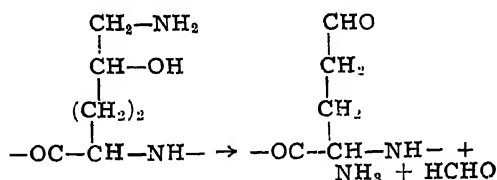
L. K. RAMACHANDRAN AND P. S. SARMA

(University Biochemical Laboratory, Madras)

PERIODATE oxidation of serine results in the formation of one mole of ammonia, one mole of formaldehyde and one mole glyoxalic acid per mole of serine.<sup>1</sup> In the case of threonine, however, one mole of ammonia and one mole of formaldehyde result, the other reaction product being apparently glyoxalic acid.<sup>2</sup> It is thought that malonic semialdehyde, resulting from the oxidation of  $\beta$ -hydroxyglutamic acid, being a  $\beta$ -aldehyde, is likely to be decarboxylated yielding acetaldehyde.<sup>3</sup> However,  $\beta$ -hydroxyglutamic acid is an unusual protein constituent. Speaking generally, the aldehyde acids arising from the periodate oxidation of hydroxy-amino acids, have not so far been much studied.<sup>4</sup>

In the case of hydroxylysine (1, 6-diamino-5-hydroxy caproic acid) periodate oxidation was found to yield one mole of ammonia and one mole of formaldehyde per mole of the amino acid.<sup>5</sup> This has been confirmed by various workers.<sup>6-11</sup> The other reaction product is expected to be glutamic semialdehyde,  $\text{OHC-CH}_2\text{-CH}_2\text{-CH(NH}_2\text{)-COOH}$ , whose existence may be doubted since it would cyclise easily. The compound is not, in fact, listed in literature even though it has been recently suggested as an intermediate in protein metabolism. For some time, we have tried to isolate this aldehyde as a derivative, under favourable experimental conditions.

The technique consists in the treatment of intact gelatin in aqueous solution with periodic acid under optimum conditions, when one mole of ammonia and one mole of formaldehyde would be split off, leaving the glutamic semialdehyde bound in peptide linkage in the protein molecule itself:



This scheme was based on our observation<sup>11</sup> that all the functional groups of hydroxylysine in gelatin are free, at least as far as the reaction with periodate was concerned, based on analyses of the hydroxylysine content of the native protein and its hydrolysate, and on the

further observation that a sulphuric acid hydrolysate of periodate-treated gelatin does not contain any hydroxylysine as analysed by the method of Van Slyke<sup>5</sup> and Macpherson.<sup>6</sup> In the face of such evidence, the recent suggestion<sup>12</sup> that the amino-acid may be bound to the protein molecule by an amide linkage at the  $\epsilon$ -position lacks experimental support. The treated protein was hydrolysed under reducing conditions ( $\text{SnCl}_2\text{-HCl}$ ), the hydrochloric acid and the stannous ion removed, treated with 2, 4-dinitrophenylhydrazine and the hydrazone formed extracted with ethyl acetate and recrystallised.

A neutralised sulphuric acid hydrolysate of the treated gelatin contained no hydroxylysine, possibly due to oxidation of the aldehyde to glutamic acid under the experimental conditions of autoclaving for effecting the hydrolysis, and yielded no crystalline semicarbazone after suitable treatment. It was further found that from a sample of a  $\text{SnCl}_2\text{-HCl}$  hydrolysate, answering the phenylhydrazone colour test, the aldehyde-acid could be extracted fairly efficiently at a pH of 7-8 with ether. But on the large-scale the extraction at pH 7.5 with ether was extremely difficult due to absence of a clear separation of the layers in the presence of the small amounts of precipitated  $\text{Sn(OH)}_2$ . Even after the removal of the tin as stannous sulphide the ether was not found to extract the aldehyde acid efficiently. Where the 2, 4-dinitrophenylhydrazine treatment was carried out prior to the removal of the tin the hydrazone was found to be strongly absorbed and carried down by the precipitate of stannous sulphide and could not be extracted.

The experimental details which yielded finally the pure crystalline hydrazone are indicated below.

## EXPERIMENTAL

200 g. gelatin (Kodak brand, moist. Analysing 1.08% hydroxylysine as percentage of the total nitrogen by the periodate- $\text{NH}_3$  method applied<sup>1</sup> to the intact protein<sup>11</sup>) were dissolved in 1,200 c.c. warm water (60° C.), cooled to R.T. and the following reagents added in order with thorough mixing during and after each addition: 100 c.c. 2N NaOH, 100 c.c. 0.15M  $\text{HIO}_4$  and 100 c.c. saturated potassium carbonate solution. The

#### 4 Isolation of 2, 4-Dinitrophenylhydrazone of Glutamic Acid Semialdehyde [Current Science

mass was well stirred. During the addition of the potassium carbonate solution the mass turned highly viscous. It was left to stand at 37° C. for 4 hrs., during which period, there was a definite fall in viscosity. It was now placed in the centre compartment of a three-compartment wax-coated wooden cell, the compartments being separated by parchment paper and the side compartments being filled with distilled water to the same level. Carbon electrodes were placed one in each of these and connected through a proper resistance to a 220 volts D.C. main so as to get a final current strength of 0.5 amp. The electrodialysis was carried out for a period of 68-92 hrs. until the treated gelatin in the centre compartment was absolutely free of all electrolytes. The contents of the side compartments were replaced by fresh distilled water at intervals. The gelatin solution was found to have regained its original reaction at the end of this period.

1 litre of concentrated hydrochloric acid containing 10 g. stannous chloride was added to the electrodialysed gelatin the mixture placed in a 3 litre bolt head flask and gently boiled under reflux on a Babo air-bath for 16 hrs. After the hydrolysis the whole was concentrated to a volume of 250 c.c. under reduced pressure and diluted to 4 litre with water and treated with  $H_2S$ . The precipitated tin sulphide was removed by filtration and the filtrate and washings concentrated to 2 litres. To this was added, 3 g 2, 4-dinitrophenylhydrazine and the whole heated at 100° C. on a steam-bath for 15 min. Afterwards it was cooled down and concentrated under reduced pressure to a volume of 500 c.c. and the hydrazone present extracted with ethyl acetate. The combined extracts were dried with anhydrous sodium sulphate. Most of the extract was evaporated at room temperature to remove the ethyl acetate and the crude residue recrystallised from ethanol after norit treatment. The reddish orange highly crystalline hydrazone weighed nearly 400 mg. Previous trials had shown that most other organic solvents used in the recrystallisation of 2, 4-dinitrophenylhydrazones were not helpful in the present case. The hydrazone had the m.p. 119-20° (Uncorr.) and under the microscope the crystals appeared needle-shaped and in clusters.

**Analysis.**—N content determined by Pregl's

micro method—22.56%; Do. calculated for  $C_6H_4N_4O_4C_5H_9NO_2$ —22.5%. Molecular weight by Rast's method was found to be 308, while the value calculated for the above formula is 311.2.

Another small portion of the ethyl acetate extract was applied to an alumina column (30 × 2 cm.) packed with the help of ethyl acetate. The column was developed by further addition of ethyl acetate and eluted with the same solvent under a pressure head of 25 mm. Hg. There were observed a fast moving yellow diffuse zone corresponding to the unreacted reagent and a slower moving but sharply defined single reddish brown band. The latter was eluted out and the eluate on evaporation again yielded the hydrazone with the m.p. 119-20°.

Thus the 2, 4-dinitrophenylhydrazone isolated, and analysed as above, appears to correspond to that of glutamic semialdehyde, the melting points of the 2, 4-dinitrophenylhydrazones of most of the other commoner aldehydes being quite different. It is to be expected that further confirmation regarding the identity of this third periodate oxidation product from hydroxylysine would become available since four methods have recently been reported for the synthesis of hydroxylysine.<sup>12-14</sup> Further, the isolation and characterisation of this compound would be easier with pure synthetic hydroxylysine.

**Acknowledgment.**—One of us (L. K. R.) wishes to thank the University of Madras for a Research Studentship during the tenure of which this work was carried out.

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## INDIAN ACADEMY OF SCIENCES

THE Seventeenth Annual Session of the Indian Academy of Sciences was held at the University of Delhi from 27th to 30th December, 1951. Professor Sir C. V. Raman presided over the session. President Rajendra Prasad, who inaugurated the session, stressed that scientists should devote their time and energy, their intellect and knowledge, for the welfare of the common man. The Presidential Address of Professor Raman was devoted to the "Structure and Properties of Silica". He mentioned in particular the optical rotation of crystalline quartz and revealed that recent researches in his Institute by Mr. S. Chandrasekhar have led to a new formula for the rotatory dispersion of the crystal and that this formula may lead to a better understanding of the mechanism of optical rotation of quartz and also of crystals in general.

A special feature of the sectional meetings

was the interesting symposium on the *Physics of Thunderstorms* in which several members of the Meteorological Department and the Directorate of Civil Aviation took part. The subjects dealt with were the thermodynamics and electrical aspects of thunderstorms and also their bearing on the structure of aircraft. There were also public lectures by Prof. P. Maheswari on 'Botany and Our Food Supply', and by Prof. Sir C. V. Raman on the 'Electrical Properties of Crystals'.

Professors P. W. Bridgman, R. A. Daly, H. von Euler-Chelpin and K. H. Meyer were elected Honorary Fellows, and B. S. Chauhan, R. L. M. Ghose, C. P. Gnanamuthu, A. R. Gopal Aiyengar, N. S. Govinda Rao, D. R. Malhotra, S. M. Mehta, S. Raghavendra Rao, P. S. Sarma and B. D. Tilak were elected Ordinary Fellows of the Academy, during the session.

## INDIAN MATHEMATICAL SOCIETY

THE Seventeenth Biennial Conference of the Indian Mathematical Society was held at Bangalore under the auspices of the University of Mysore on the 22nd, 23rd and 24th December, 1951. Sir C. V. Raman delivered the Inaugural Address. In his Presidential Address to the Session, Dr. T. Vijayaraghavan referred to the present position of mathematical research in India, and discussed the needful requisites for effecting an over-all improvement. The mathematical part of his address was concerned with some problems on Summability and Tauberian Theorems as also problems in the Theory of Numbers.

A Mathematical Exhibition, showing models of various geometrical surfaces including surfaces that are met with in differential geometry, charts and models relating to topology (knots,

four-colour problem, etc.), and diagrams of geometrical constructions were arranged in the Department of Mathematics, Central College.

About 30 papers were presented to the Conference. Besides the discussion on these, there were three Symposia on (1) Bourbaki, (2) Geometry of Numbers and (3) The Role of Mathematics in Engineering, the last of which was held at the Indian Institute of Science. There were two popular lectures, one by Sir C. V. Raman, on "The Scattering of Light in Crystals", and the other by Dr. H. J. Bhabha who made a general survey of the entire field of mathematical physics and referred to the part played by mathematics in the development of physics.

C. N. S.

## LADY TATA MEMORIAL TRUST SCIENTIFIC RESEARCH SCHOLARSHIPS, 1952-53

THE Trustees of the Lady Tata Memorial Trust are offering six Scholarships of Rs. 250 each per month for 1952-53 commencing from July 1, 1952. Applicants must be of Indian nationality and Graduates in Medicine or Science of a recognised University. The Scholarships are tenable in India only and the holders must undertake to work wholtime under the direction of the Head of a Scientific Department in a recognised Research Institute or Laboratory

on a subject of scientific investigation that must have a bearing either directly or indirectly on the alleviation of human suffering from disease. Applications must conform to the instructions drawn up by the Trustees and must be received before 15th March 1952. Candidates can obtain these instructions and other information they desire from the Secretary, The Lady Tata Memorial Trust, Bombay House, Bruce Street, Fort, Bombay 1.

## LETTERS TO THE EDITOR

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BAND SPECTRUM OF OXIDES OF  
CALCIUM AND MAGNESIUM

A DETAILED study of the visible and near ultra-violet bands associated with the oxides of calcium<sup>1,2,3</sup> and magnesium<sup>4</sup> is reported here with a view to improve upon the present state of our knowledge of these molecules.

The bands of calcium oxide were produced by introducing it in the cavity on the lower electrode of a carbon as well as a copper arc in air. The magnesium oxide bands were produced by burning small strips of magnesium ribbons in air and also by running an arc in air with magnesium electrodes. The spectra were photographed on a Hilger E<sub>1</sub> Quartz spectrograph as well as in the 1st, 2nd, 3rd and 4th orders of a 3-metre concave grating having a dispersion of approx. 6 Å per mm. in the 1st order.

**MgO Green and Ultra-Violet Bands:** The wavelengths obtained in the present measurements significantly differ from

those reported previously. Barrow's data for the (2, 0) sequence agree with the present ones but in addition prominent band heads at  $\lambda$  air 4779.65; 4762.18; 4756.10; 4747.80; 4736.14 Å, have also been observed. As for the bands in the (0, 0) sequence, some of the present measurements agree with those of Mahanti,<sup>1</sup> while the rest do not. Besides the band heads obtained by Barrow, a number of additional bands have been observed; of these the bands with heads at  $\lambda$  3,966.89, 3,981.31, 3,994.55, 4,007.56 and 4,019.97 Å appear to belong to one sequence.

Barrow observed the bands only up to  $\lambda$  3,594 Å. In the present experiment the lower wavelength limit has been extended to  $\lambda$  2,936 Å.

**CaO Blue Bands:** A large number of band heads have been measured but only those with wavelengths at  $\lambda$  4,567.8, 4,530.2, 4,351.2, 3,994.5, 3,977.0, 3,773.7, 3,712.2, 3,656.6 Å can be reported with confidence. Measurements of other

band heads differ significantly from those of Mahanti and Brodersen and it is difficult to say whether they are genuine band heads or are just aggregates of lines giving false impression of band heads.

The rotational structure of some of the bands of CaO in the ultra-violet, orange and green region and of magnesium oxide in the green and ultra-violet have also been measured. Full details of the work will be published elsewhere.

My thanks are due to Prof. L. M. Chatterjee and Dr. S. P. Sinha for their kind interest and to the Patna University for the award of a Research Scholarship.

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November 3, 1951.

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### X-RAY STUDY OF THE STRUCTURE OF SILVER AMALGAMS

THE crystal structure of silver amalgam has been studied by various authors using the X-ray<sup>1,2,3</sup> and electron diffraction<sup>4,5,6</sup> methods. Even in cases where the amalgam is prepared in the same manner, the two methods give results widely different from each other. The previous investigators have, however, confined themselves only to powder photographs. In the present investigation, the powder method was used with amalgams prepared by the following methods:

- (a) by directly mixing silver filings with mercury.
- (b) by the action of a solution of silver nitrate on mercury.
- (c) by the electrolysis of silver, using a cyanide bath.
- (d) by the action of a saturated solution of mercuric chloride on thin silver foil.
- (e) by boiling mercury with pieces of silver foil in *vacuo*.
- (f) by the action of a solution of silver nitrate and cuprous iodide in anhydrous pyridine, on a drop of mercury.<sup>7</sup>

Also single crystals of amalgam produced by the method (b) were studied by the rotation method. This is the first time that X-ray studies

have been made with single crystals of silver amalgams. The results are given below:

TABLE

Method of preparation	% wt. of silver	Phase	$a_0$ in Å.
<i>a</i>	.. 27.59	$\gamma$	9.955
<i>b</i>	.. 16.17	$\gamma$	9.983
<i>c</i>	.. 17.04	$\gamma$	9.986
<i>c</i>	.. 26.99	$\gamma$	10.019
<i>c</i>	.. 27.98	$\gamma$	10.021
<i>c</i>	.. 28.40	$\gamma$	9.998
<i>c</i>	.. 37.50	$\gamma$	10.013
		$\alpha$	4.064
<i>e</i>	.. 48.22	$\gamma$	10.027
		$\alpha$	4.083
<i>e</i>	.. 61.30	$\gamma$	10.008
		$\alpha$	4.076
<i>d</i>	.. ..	$\gamma$	10.006
<i>e</i>	.. ..	$\gamma$	10.00
<i>f</i>	.. ..	$\gamma$	10.027
<i>b</i>	.. ..	$\gamma$	10.063 <sup>+</sup>

<sup>+</sup> Single crystal investigation.

The calibration of the camera radius was done by using rock-salt as the standard. The values of the lattice constants given are correct to about 0.2%. The third decimal place is given for information.

Preston and others working on amalgams with varying contents of silver, ranging from 25% to 100% (prepared by directly mixing silver and mercury), report that when the silver content is about 30%, the amalgam shows a body-centred cubic structure ( $\gamma$ -phase). When it is between 30% and 40%, the  $\gamma$ -phase exists simultaneously with the hexagonal close-packed structure ( $\beta$ -phase), and between 40% and 50%, the  $\beta$ -phase exists along with the  $\alpha$ -phase of free silver, while beyond 50% only the  $\alpha$ -phase is found. On the other hand, the present investigations, summarised in the above Table, show that: (1) the  $\gamma$ -phase starts even at 16% of silver, existing in equilibrium along with free mercury phase, (2) there is no evidence at any stage of the appearance of the  $\beta$ -phase, (3) the  $\gamma$ -phase persists even above 35% of silver along with the  $\alpha$ -phase. These results differ from those of earlier workers, which is probably due to the fact that the methods of preparation are different.

The chemical formula corresponding to the crystals of the  $\gamma$ -phase (suggested variously as  $\text{Ag}_2\text{Hg}_3$ ,  $\text{Ag}_3\text{Hg}_4$ ,  $\text{Ag}_4\text{Hg}_5$ , etc.), is yet to be definitely established by a detailed analysis. Further work on the subject is in progress and the details will be published elsewhere. One of

us (T. G. S.) is indebted to the Government of India for the award of a Research Scholarship. First Grade College, Tumkur, S. RAMA SWAMY. Central College, Bangalore, T. G. SHAMANNA, November 14, 1951.

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### THIRD ORDER ELASTIC COEFFICIENTS OF ISOTROPIC SOLIDS

FUMI<sup>1</sup> recently obtained the third order elastic coefficients for all the thirty-two point groups. For a cubic crystal, these reduce to six independent coefficients and may be described by the following relations:

$$\begin{aligned} C_{111} &= C_{222} = C_{333} \\ C_{112} &= C_{133} = C_{223} = C_{113} = C_{332} = C_{122} \\ C_{144} &= C_{366} = C_{255} \\ C_{166} &= C_{244} = C_{355} = C_{344} = C_{266} = C_{155} \\ C_{123} \\ C_{456} \end{aligned}$$

In the case of isotropic solids, there are three further relations between these six, namely,

$$\begin{aligned} C_{166} &= 3 C_{111} - C_{112} \\ C_{123} &= 2 C_{112} - C_{144} \\ C_{456} &= 2 (C_{166} - C_{144}) \end{aligned}$$

Thus the number of independent coefficients reduces to three. That this number is only three for an isotropic solid is well known.<sup>2</sup> In this note we give the actual surviving coefficients.

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### HEAT CONDUCTIVITY-VISCOSITY RELATIONSHIP FOR LIQUIDS AT THE FREEZING POINT OF WATER

It has been shown by the author<sup>1</sup> that the coefficient of heat conductivity  $K$  and that of viscosity  $\eta$  for a liquid are related in the form

$$MK/\eta = 3R, \quad 1(a)$$

where  $M$  is the molecular weight of the liquid and  $R$  the gas constant. Since  $R$  in calories is very nearly 2,

$$MK/\eta = 6; \quad 1(b)$$

$K$  is in calories and  $\eta$  in poises. The possibility of correction of the numerical coefficient in 1 (a), similar to that applied to the kinetic theory equation connecting  $K$  and  $\eta$  for a gas, is not excluded. This relation was applied at the boiling point b.p. (a 'corresponding' temperature), when it was found<sup>2</sup> that, for a number of liquids,

$$MK_{bp}/\eta_{bp} = \text{Constant} = 10.8.$$

The derivation of the above relationship postulates, after Andrade,<sup>3</sup> a model for the liquid state in which the molecules are regarded as executing vibrations as in a solid. The chief difference between the two states is that in the former the amplitudes of the vibrations are large enough for the molecules to collide with neighbours at every extreme displacement. Equations 1 (a) and 1 (b) should, therefore, be valid only at the freezing point, since at this temperature the liquid structure approximates, most closely, to the above picture.

In recent years,  $K$  for water has been measured, at a number of temperatures in the range 0-80° C. by Jakob,<sup>2</sup> Kaye and Higgins,<sup>3</sup> Martin and Lang,<sup>4</sup> and Bates.<sup>5</sup> Values for  $K$  at 0° C., the freezing point of the liquid, due to the above workers are respectively 0.001325, 0.00145, 0.001394 and 0.00134 calories. We select for the following calculations the value due to Bates,<sup>4</sup> viz., 0.00134. The viscosity of water at this temperature as given by Bingham and Jackson<sup>6</sup> is 0.01792 poise. Water is an 'associated' liquid, and therefore  $M$  in the equations 1 (a) and 1 (b) should be replaced by  $nM$ , where  $n$  is the 'association factor'. This last for the liquid at 0° C. is 4.18 (Macleod<sup>7</sup>). Therefore,

$$nMK_f/\eta_f = 5.6,$$

a value in good agreement with the theoretical value, viz., 6.

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## STUDIES IN CATALYTIC OXIDATION OF ETHYLENE TO ETHYLENE OXIDE

THE catalytic oxidation of ethylene to ethylene oxide employing a static bed of catalyst has been the subject of a number of patents and a few publications.<sup>1-4</sup> Promoted silver oxide deposited on metallic or non-metallic supports has been mainly employed as the catalyst. Though the use of refractory materials like fused alumina, fire brick, sandstone and artificial silica, as catalyst supports has been mentioned in patent literature, the only significant published work is that of McBee, *et al.*,<sup>3</sup> who have employed synthetic corundum as the carrier. A conversion of 30% (on the basis of ethylene fed) and a selectivity of 45% for ethylene oxide are reported at a space velocity of 1,500 with an air-ethylene ratio of 17.5.

In this reaction, besides ethylene oxide, carbon dioxide has been found to be invariably formed as the product. The reactions leading to the formation of both ethylene oxide and carbon dioxide are exothermic. As a result of this, the temperature of the catalyst bed rises to values far beyond the optimum. High temperatures lead to the excessive production of carbon dioxide and thus to poor yields of ethylene oxide. So, it is essential that the catalyst bed be maintained within narrow temperature limits during operation. Considering the various advantages offered by the Fluidized Bed Technique, particularly, the high heat transfer coefficients, uniform heat distribution and rigid temperature control, a study of the above reaction employing this technique was undertaken.

Lack of comprehensive data on the various aspects of this reaction using non-metallic supports compelled us to undertake, as a first step, a thorough investigation of the reaction in the static bed also.

Precipitated silver oxide promoted with barium peroxide and deposited on various non-metallic carriers was employed as the catalyst. The effect of variables, *viz.*, promoter concentration, temperature, space velocity and air-ethylene ratio was studied in each case.

The incorporation of barium peroxide to silver oxide was found to be essential for good adherence of the catalyst on the support. Besides, it improved the performance of the catalyst.

It was found that with the increase in the concentration of barium peroxide the adherence of the catalyst on the carrier improved (Table I). But when the concentration of barium peroxide was above 10 per cent. the

TABLE I

Concentration of  $\text{Ag}_2\text{O} = 0.453$  gm./c.c. of quartz

No.	$\text{BaO}_2$ on the wt. of $\text{Ag}_2\text{O}$ , per cent.	Space velocity, c.c./hr./c.c.	Air- $\text{C}_2\text{H}_4$ ratio	Optimum bath temp., °C.	Total conversion, per cent.	Selectivity of ethylene oxide, per cent.	Space-time yield, c.c./hr./c.c.
1	6.0	1500	11.2	260	48.5	58.2	34.7
2	10.2	1370	11.0	260	46.1	59.7	36.5
3	17.8	1565	12.8	300	49.9	41.0	25.1

optimum temperature rose to 300° C. and the selectivity decreased.

TABLE II

Concentration of  $\text{Ag}_2\text{O} = 0.453$  gm./c.c. of carrier  
Concentration of  $\text{BaO}_2 = 6.0$  per cent. on the weight of  $\text{Ag}_2\text{O}$ .

No.	Catalyst support	Space velocity, c.c./hr./c.c.	Air- $\text{C}_2\text{H}_4$ ratio	Optimum bath temp., °C.	Total conversion per cent.	Selectivity of ethylene oxide, per cent.	Space-time yield, c.c./hr./c.c.
1	Natural corundum	1400	10.6	260	36.5	32.9	14.0
2	Do	3020	24.6	260	26.9	46.7	14.8
3	Pumice	1480	10.3	260	33.3	41.7	18.2
4	Do	2980	20.2	260	25.9	49.5	18.0
5	Kieselguhr	1510	10.7	280	12.7	32.1	4.6
6	Activated alumina	1525	21.2	210	29.6	negligible	
7	Quartz	1500	11.2	260	43.5	58.2	34.7
8	Do	2915	23.3	270	42.9	55.1	28.3

It is evident from the data presented in Table II that the conversion and the selectivity are best in the case of quartz supported catalyst, are best in the case of the quartz supported catalyst.

The results of these investigations may be summarized as follows:

- The general behaviour of the catalyst is independent of the nature of the support employed.
- The fresh catalyst is highly reactive and degradative but after continued use for about 12 hours, it attains a steady state.
- Beyond the optimum temperature the yield of ethylene oxide decreases but that of carbon dioxide increases. This is due to the formation of 'hot spots'.
- When the space velocity is increased the air-ethylene ratio also must be progressively increased in order to obtain good yields of ethylene oxide.

(v) A decrease in contact time lowers the total conversion though the selectivity remains almost the same.

The results of the investigations in the fluidized bed will be published separately.

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### ESTIMATION OF PHENOLPHTHALEIN

In an investigation on the labelling of *Vanaspati* (hydrogenated fat), we found that phenolphthalein dissolves in fat and is, therefore, capable of being used as a tracer. To establish whether or not this tracer in the fat medium would be removed by treatment with animal charcoal or Fuller's earth, we had to estimate phenolphthalein, which, as originally added, was 10 mg. per cent. on the weight of fat. The gravimetric procedure of the A.O.A.C. (1), which is applicable to quantities of phenolphthalein of not less than 0.2 g., could not be used for this estimation. Nor did a review of the literature available reveal a method as would estimate accurately such small quantities of phenolphthalein in the presence of such large excess of fat. Volumetric estimation of phenolphthalein, using iodine, is the basis of the method developed by us.

**Method.**—To 20 mg. phenolphthalein dissolved in 25 ml. 0.25% NaOH, 10 ml. of sodium bicarbonate are added, followed by 10 ml. of iodine (0.1 N). The volume is then made up to 100 ml. Blank is done under identical conditions, but without phenolphthalein. Aliquots of the mixture within 10 minutes of the reaction are titrated as follows: to a mixture of about 190 ml. distilled water, 5 ml. of 2% starch solution, 2 ml. of 10% KI and 5 ml. of 10%  $H_2SO_4$  contained in a 400 ml. beaker (tall form), very dilute iodine is added dropwise till a faint blue colour appears. To the medium thus prepared, a 50 ml. aliquot of the reaction mixture is run in slowly, keeping the contents of the beaker well-stirred with a glass rod, during the addition. The mixture, under stirring, is titrated against standard

thio (N/50), delivered from a micro-burette. The end point is reached when the blue colour (starch-iodine) disappears and the solution becomes red (due to the precipitate of tetraiodophenolphthalein in suspension). Or, preferably, as the end point approaches, the precipitate is allowed to settle, and the colour is judged in the supernatant liquid by looking through the beaker against transmitted light.

Factor: 1 ml. 0.1 N Iodine = 0.003976 g of phenolphthalein.

In dealing with different quantities of phenolphthalein to be estimated, the reaction mixture should be made up in the above proportions in relation to the quantity of phenolphthalein present. Under these conditions, the solution is clear and has the colour of iodine solution. When bicarbonate is deficient and alkali is in excess, the colour is blue to blue-purple.

The method gives a value of 99.9%  $\pm$  0.06 (S.E.), as determined in 25 estimations, using different quantities of phenolphthalein varying from 10 mg. to 220 mg.

The usefulness of the method has been demonstrated by its successful application to the estimation of phenolphthalein in preparations. These results will be found in the fuller paper being published elsewhere.

Our thanks are due to Dr. V. Subrahmanyam, Director of the Institute, for his interest in the investigation and helpful criticisms.

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October 19, 1951.

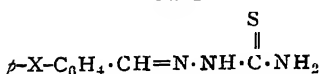
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### ANTI-TUBERCULOUS THIOSEMI-CARBAZONE COMPOUNDS

THE introduction of p-substituted benzaldehyde thiosemicarbazones and particularly p-acetaminobenzaldehyde thiosemicarbazone (I) also known as TBI-698 or "Conteben" in Germany and "Tibione" in the United States, in the treatment of tuberculosis<sup>1,2,3</sup> has aroused considerable interest in the field of thiosemicarbazones as possible antituberculous compounds. The compound shows high activity *in vitro* and *in vivo* tests.<sup>2,4</sup>

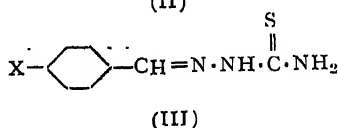
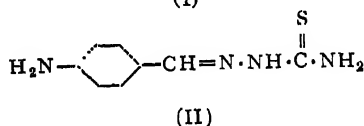
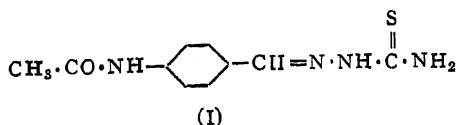
A study was started in our laboratory with the aim of preparing a few Schiff's bases, of p-amino-benzaldehyde thiosemicarbazone (II) by its condensation with aromatic aldehydes, which

TABLE



No.	X	Molecular formula	M.P. °C
1	$\sigma\text{-(O}_2\text{N)-C}_6\text{H}_4\text{-CH=N-}$	$\text{C}_{15}\text{H}_{13}\text{N}_5\text{S}$	194-195
2	$m\text{-O}_2\text{N-C}_6\text{H}_4\text{-CH=N-}$	$\text{C}_{15}\text{H}_{13}\text{N}_5\text{S}$	208-209
3	$p\text{-O}_2\text{N-C}_6\text{H}_4\text{-CH=N-}$	$\text{C}_{15}\text{H}_{13}\text{N}_5\text{S}$	206-207
4	$p\text{-(CH}_3)_2\text{N-C}_6\text{H}_4\text{-CH=N-}$	$\text{C}_{17}\text{H}_{19}\text{N}_5\text{S}$	209-210
5	$p\text{-(C}_2\text{H}_5)_2\text{N-C}_6\text{H}_4\text{-CH=N-}$	$\text{C}_{19}\text{H}_{23}\text{N}_5\text{S}$	192-193
6	$p\text{-CH}_3\text{O-C}_6\text{H}_4\text{-CH=N-}$	$\text{C}_{16}\text{H}_{16}\text{ON}_4\text{S}$	187-188
7	$2, 3, 5\text{-(OH)(I)(I)-C}_6\text{H}_3\text{-CH=N-}$	$\text{C}_{15}\text{H}_{12}\text{ON}_4\text{SI}_2$	229-230
8	$2, 5\text{-(OH)(Br)C}_6\text{H}_3\text{-CH=N-}$	$\text{C}_{15}\text{H}_{13}\text{ON}_4\text{SBr}$	223-224
9	$\text{CH}_2\text{-CO-NH-}$ $\text{CH}_2$ $\text{COOH}$	$\text{C}_{12}\text{H}_{14}\text{O}_3\text{N}_4\text{S}$	210-211
10	$p\text{-CH}_3\text{-CONH-C}_6\text{H}_4\text{-SO}_2\text{-NH-}$	$\text{C}_{16}\text{H}_{17}\text{O}_3\text{N}_5\text{S}_2$	239-240

may possibly have good antituberculous activity. The amino group in (II) has also been acylated with succinic anhydride and *p*-acetaminobenzene sulphonyl chloride to give *p*-( $\beta$ -carboxy propionamido) benzaldehyde thiosemicarbazone and 4-(*p*-acetaminobenzene-sulphonyl)-aminobenzaldehyde thiosemicarbazone, respectively.



**Experimental.**—*p*-Aminobenzaldehyde thiosemicarbazone (0.01 M.) and the corresponding aldehyde (0.01 M.) were refluxed in ethyl alcohol (50 c.c.) for a period of 1 to 2 hours. The Schiff's base which separated on cooling was filtered and washed with alcohol. The crude product was crystallised from rectified spirit.

Acylation of II with succinic anhydride and *p*-acetaminobenzene sulphonyl chloride was done in acetone and pyridine, respectively.

The compounds of the general formula (III) with their melting points are listed in the Table.

Full details will be published later. Tests for the antituberculous activity of the compounds

are in progress. Thanks are due to Professor P. C. Guha for his active interest in this work.

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#### SEPARATION AND IDENTIFICATION OF AMINO ACIDS FROM PROTEIN HYDROLYSATES BY CIRCULAR PAPER CHROMATOGRAPHY

CIRCULAR paper chromatography as originally described by Giri<sup>1</sup> cannot be adapted to the identification of amino acids by running mixed chromatograms as in the case of widely used unidimensional chromatogram made by the "ascending" and "descending" techniques. A new technique eliminating the above limitation of this method has been developed by Giri and Rao.<sup>2</sup> The present communication describes an attempt to examine the possibility of the application of this technique to the identification of amino acids separated from casein hydrolysate.

The casein hydrolysate prepared by hydrolysing casein with 6 N sulphuric acid and neutralising with barium hydroxide contained 5.6 mg. of amino nitrogen per ml. 10  $\mu$  l. of the hydrolysate was spotted on the circumference of a circle drawn with a pencil from the centre of the circular filter paper. The mixture of known

amino acids was spotted at positions marked M between the spots at positions marked H relating to the hydrolysate. The chromatogram was run and developed as described before.<sup>1</sup> Fig. 1 is the chromatogram illustrating the



Fig. 1. Circular paper chromatogram showing the separation of amino acids in casein hydrolysate using *n*-butanol-acetic acid water as developing solvent. The hydrolysate was introduced on to the paper at the centre before the slit was cut.

separation of amino acids from casein hydrolysate spotted at the centre of the paper into at least twelve distinct circular zones each representing one or more amino acids. Fig. 2 is the mixed chromatogram of the hydrolysate and a known mixture of amino acids run on the same paper. It is clear from Fig. 2 that the amino acids present in the hydrolysate can be readily identified by reference to the arcs of the known amino acids formed on the circumference of the same circle. The presence of histidine, aspartic acid, proline, leucine, lysine, threonine, phenylalanine, arginine, glutamic acid, methionine, is indicated from Fig. 2. By running similar mixed chromatograms, glycine, serine, valine, iso-leucine, alanine, cystine and tyrosine in the casein hydrolysate have also been identified by reference to the arcs of the amino acids run on the same paper. The overlapping circular zones of amino acids with *R<sub>f</sub>* values very near each other can be separated into individual zones and identified by multiple development technique.<sup>1</sup>

This technique is now being applied to the study of the hydrolysis of proteins by enzymes and to the amino acid analyses of normal and pathological urine, blood, and tissues.

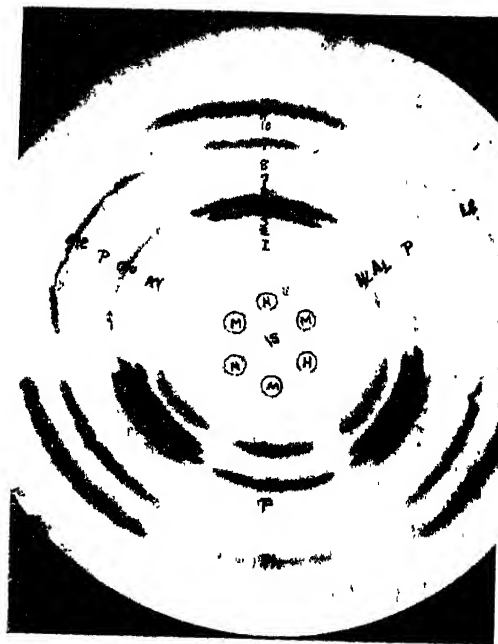


Fig. 2. Circular paper mixed chromatogram showing the separation and identification of histidine (*H*), aspartic acid (*A*), proline (*P*), leucine (*L*), lysine (*Ly*), threonine (*Th*), phenylalanine (*Ph*), arginine (*Ar*), glutamic acid (*Glu*), and methionine (*Me*). Developing solvent: *n*-Butanol-acetic acid-water.

Added Jan. 1952

Since submitting this note we have found that instead of cutting a slit at the centre and inserting a paper strip for irrigation with the solvent as described originally, a cylindrical "wick" (2-3 mm. thickness) cut at the end into the form of a brush and inserting it into a hole (2-3 mm. diameter) made at the centre of the paper, was found to be more convenient and uniform circular zones could be obtained by this modification.

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# EFFECT OF DIFFERENT MECHANICAL FRACTIONS ON THE EFFICIENCY OF NITRIFYING ORGANISMS

THE nitrifying capacity of the different fractions of the manured and unmanured alluvial soil as affected by continuous cropping of wheat has been studied by adding 2.0 gm. of different fractions in 100 c.c. of Omeliansky Medium.<sup>2</sup> The joint effect of these fractions on nitrification was studied by mixing 2 gm. of them in the same proportion as they existed in the soil. The medium, after inoculation with pure culture of nitrifying organisms, was incubated for a fortnight. After incubation the medium was analysed for nitrate content. The results are incorporated in the following Table.

Nitrate Formed in Presence of Different Mechanical Fraction in p.p.m.

Fractions	Manured			Unmanured		
	0-6"	6"-1'	1'-2'	0-6"	6"-1'	1'-2'
Clay ..	8.02	6.96	5.15	9.52	8.39	6.12
Silt ..	5.10	4.39	3.11	6.93	6.74	3.59
Sand ..	3.75	3.12	2.93	4.12	3.57	2.63
Sand + Silt ..	4.25	4.10	3.00	5.31	4.97	3.11
Sand + Clay ..	4.95	4.53	3.27	6.29	6.00	4.39
Silt + Clay ..	5.25	5.11	4.05	6.79	6.95	5.41
Sand + Silt + Clay	6.97	5.93	4.99	7.87	7.74	6.05

It is apparent from these results that as in the case of nitrogen fixation<sup>1</sup> the finely divided fraction has some physiological influence on nitrification. Finer the fractions, greater is the nitrification. This phenomenon may be due to the greater surface exposed for the absorption of the nutrients. It appears that these fractions aid in nitrification by replenishing ions in the medium when they are removed by the growing organisms.

All the three mechanical fractions in general, from the unmanured plot encouraged greater nitrification than the corresponding fractions from the manured plot, clay definitely possessing greater nitrifying capacity than silt and sand in both the soils. The surface soil indicated higher activity in both the plots. When these fractions were mixed in the same proportion as they occur in soil, the maximum amount of nitrate was found when all the three, viz., sand, silt and clay were present. Hence the continuous growing of wheat without manure appears to have modified the nitrifying capacity of the soil as a whole and also of the individual fractions, so that the various mechanical fractions enhanced the efficiency of nitrate pro-

ducers in the unmanured soil as compared to those from the soil manured and cropped.

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## STUDIES ON THE THIAMINASE IN VAUNSHI (MUGIL Sp.)

THIAMINE inactivating mechanism associated with carp and certain other varieties of fresh-water fish, was reported by various workers.<sup>1-4</sup> Recently Giri, Reddy and Das<sup>5</sup> have shown the presence of such a factor in fresh-water mussel. The present note deals with the distribution of thiaminase in Vaunshi (*Mugil* sp.), a brackish-water variety of edible fish which is very popular in Bombay.

Thiaminase activity was determined by incubating overnight (16 hours) the fish extract in acetate buffer (pH 5.6) with 25 µg of thiamine at room temperature (27° C.-30° C.) with toluene as a preservative and estimating the amount of thiamine left over. The amount of thiamine destroyed was a measure of thiaminase activity. Thiamine was estimated by the thiochrome method as described by Bhagwat.<sup>6</sup> A parallel incubation was carried out with boiled extract every time. A "Live Control", i.e., the extract without boiling and without the substrate (Thiamine) was run simultaneously but it gave negligible values.

The enzyme from 20 gm. of whole fish was extracted with 60 ml. of different solvents such as water, chloroform-water mixture, acetate buffer (pH 5.6) and 5% sodium chloride and filtrates were tested for activity. The results are given in the following Table.

Extraction of Thiaminase with Different Solvents

Solvent	% destruction of thiamine	
1 Water	..	67.2
2 Chloroform-water mixture	..	61.2
3 Acetate buffer (pH 5.6)	..	39.6
4 5% Sodium chloride solution	..	54.4

From the above Table, it is evident that water is a better and suitable solvent in the extraction of thiaminase from Vaunshi.

Effect of hydrogen-ion concentration on the inactivation of thiamine by thiaminase was studied between pH 3.0 and 7.0 using acetate and phosphate buffers. The results expressed in terms of percentage destruction of thiamine with respect to hydrogen-ion concentration are represented graphically in Fig. 1.

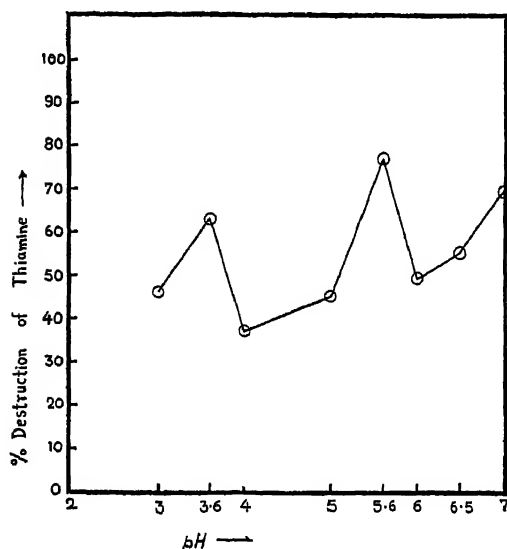


FIG. 1. Effect of pH on the Destruction of Thiamine by Thiaminase

The curve indicates that there are three different hydrogen-ion concentrations, (*viz.*, pH 3.6, 5.6 and 7.0), at which the enzyme shows optimum activity. This appears to be peculiar with this enzyme. Since carp thiaminase has been shown to exhibit optimum activity at only one pH, though the actual value for the optimum pH as reported by various workers is different, *e.g.*, pH 8.0,<sup>2</sup> pH 9.1<sup>1</sup> and at pH 6.<sup>3</sup> However, Giri, *et. al.*,<sup>5</sup> have shown the presence of two different enzymes from fresh-water mussel having optimum activity at pH 3.6 and 6.5. Thus the three optima in the pH curve with Vaunshi extract may probably be due to three enzymes exhibiting thiaminase activity.

With a view to verify this hypothesis, the effects of dialysis of the extract and the addition of certain salts were studied. It was observed that the extract lost a greater part of its activity on dialysis. The activity, however, could be restored by the addition of boiled original extract. This indicates the presence of a coenzyme. The presence of a coenzyme was reported earlier by Woolley, *et. al.*,<sup>2</sup> and Bhagwat, *et. al.*,<sup>3</sup> independently. When the effect of addition of certain salts, *viz.*,  $\text{MnSO}_4$ ,  $\text{MgSO}_4$ ,

$\text{ZnSO}_4$  and  $\text{CuSO}_4$  (M/100 concentration) to the dialysed extract was studied, it was observed that only  $\text{MnSO}_4$  could restore the activity of enzyme showing optimum activity at pH 3.6 and 5.6 respectively, while none of these could restore the activity of the enzyme exhibiting optimum activity at pH 7.0. Thus the coenzyme required for the activation of the third enzyme appears to be different. In the case of fresh-water mussel, Giri, *et. al.*,<sup>5</sup> have shown that the enzyme with optimum activity at pH 3.6 and 6.5 could be activated by  $\text{Mn}^{++}$  salts. All the above facts lead to the conclusion that there might exist at least two sets of enzymes possessing thiaminase activity.

Further work on the isolation and purification of the enzyme is in progress.

Preliminary experiments have shown that liver and spleen are good sources of the enzyme while the amount of the enzyme in ovaries, stomach, etc., is comparatively small. The rather wide distribution of thiaminase among the tissues and organs suggests that it may have an important role in the metabolic processes of the fish.

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#### THE INFLUENCE OF BORON ON THE YIELD AND CONTENT OF CARBOHYDRATE IN TOMATO FRUITS

THE importance of boron as a plant nutrient for growing healthy plants and obtaining good quality returns has been emphasised by many workers.<sup>1-8</sup> It has also been shown by a few workers<sup>1-5</sup> that carbohydrate fractions accumulate in tomato fruits and in different parts of the plant in varying amounts, as a result of complete absence or an insufficient supply of the element. An attempt has been made to determine the extent to which carbohydrate fractions accumulate in the fruits, at different stages, with higher concentrations of the element.

TABLE I  
Influence of Boron on the Yield and Content of Carbohydrate in Tomato Fruits of  
Different Stages

Treatments	Yield of fruits		Content of Carbohydrate fractions in different stages of the fruit (per 100 g. of the fruit)											
			Green				Yellow				Red Ripe			
	No. of fruits	Weight in lb.	Reducing sugar	Non-reducing sugar	Starch	Total carbohydrate	Reducing sugar	Non-reducing sugar	Starch	Total carbohydrate	Reducing sugar	Non-reducing sugar	Starch	Total carbohydrate
No Boron	61	5.54	3.97	6.58	7.91	18.46	4.02	7.65	7.34	19.01	5.32	9.81	4.72	19.85
Boron 0.5 p.p.m.	95	8.68	3.58	5.36	7.35	16.29	3.29	6.07	6.40	16.42	4.14	6.90	4.31	15.35
" 1.0 "	118	12.40	3.63	4.92	6.22	14.77	2.68	5.17	4.25	12.10	3.82	6.15	3.18	13.15
" 2.0 "	123	15.27	2.76	4.31	5.89	12.96	3.10	4.42	3.97	11.49	3.20	5.24	2.30	10.74
" 3.0 "	137	15.91	2.07	4.28	4.07	10.46	2.17	4.05	3.82	10.04	2.39	4.59	1.93	8.91

It is evident from Table I that boron increases considerably the yield of tomato fruits in number and weight, with increasing concentrations of the element. It is characteristically observed that the contents of starch decreases, and of the reducing and non-reducing sugars show a gradual increase as the fruit ripens. All the carbohydrate fractions decrease with increasing application of boron.

From this investigation it is obvious that boron either directly or indirectly influences not merely the formation and accumulation of different fractions of carbohydrate, but also its utilization in the normal physiological and metabolic processes in the plant.

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April 26, 1951.

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## INFLUENCE OF ZINC ON TOMATO FRUITS

THE utility of zinc application to successful crop production has been adequately stressed before.<sup>1-11</sup> This investigation on the influence of zinc on the yield, content of ascorbic acid, and

accumulation of carbohydrate in tomato fruits shows that the yield of fruit (Table I), both in number and weight increases with increasing doses of zinc, upto a limit. Due to increased availability, with 3 p.p.m. of zinc, a large number of flower buds are injured and the yield of fruit decreases. The maximum yield was obtained with 2.0 p.p.m. of zinc while with smaller concentrations, the yield was poor.

TABLE I  
Influence of Zinc on the Yield and Ascorbic Acid Content in Tomato Fruits

Treatments	Yield of fruits		Vitamin C content (in mgm. E.Q. per 100 c.c. of the juice) in different stages of the fruit		
	No. of fruits	Weight in lb.	Green	Yellow	Ripe (Red)
Minus zinc	111	9.73	19.20	17.56	21.80
Zinc 0.5 p.p.m.	95	8.68	17.70	19.04	20.30
" 1.0 "	144	15.92	16.60	27.08	35.20
" 2.0 "	172	16.30	19.80	24.70	34.90
" 3.0 "	152	11.35	18.10	21.00	29.20

The ascorbic acid content (Table I), normally increases with increasing availability of zinc but also with the ripening of fruit from green to red, and the maximum amount occurs in the fully ripened fruit. A number of workers<sup>1,6,7</sup> have reported an increase in Vitamin C content in tomato grown in presence of zinc than in complete absence of it.

Table II shows that different carbohydrate fractions gradually decrease with increasing concentration of zinc. The accumulation of

TABLE II  
Influence of Zinc on the Accumulation of Carbohydrate in Tomato Fruits

Treatments	Green				Yellow				Red Ripe			
	Reducing sugar	Total sugar	Starch	Total Carbo- hydrate	Reducing sugar	Total sugar	Starch	Total Carbo- hydrate	Reducing sugar	Total sugar	Starch	Total Carbo- hydrate
Minus zinc p.p.m. ..	3.91	6.61	7.48	18.00	3.27	7.03	6.91	17.21	4.33	8.79	4.82	17.94
Zinc 0.5 ..	3.58	5.36	7.35	16.29	3.99	6.07	6.40	16.46	4.14	6.90	4.31	15.35
" 1.0 ..	2.23	5.31	5.03	16.60	2.70	5.82	4.46	12.98	3.07	6.43	3.04	12.54
" 2.0 ..	2.23	4.13	5.60	11.96	2.70	5.08	4.28	12.06	2.81	6.11	2.93	11.85
" 3.0 ..	2.67	3.79	4.78	11.24	2.05	4.92	3.53	10.50	2.73	5.93	2.17	10.83

reduced and non-reducing sugars gradually increase while starch decrease from green to yellow and red. The total carbohydrate content shows a decrease both with increasing availability of zinc and as the fruit ripens. It is also observed that the total carbohydrate accumulation is slightly more in the completely ripened than in the yellow both in complete absence and with 3.0 p.p.m. of the element in the culture.

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### INHERITANCE OF SHORT LINT MUTANT IN COCANADAS COTTON

THE occurrence of a new lint quantity mutant (CST 1) designated as *short lint* registering a mean combed halo length of 5 to 10 m.m. and a mean ginning outturn of 6 to 9 per cent. was reported<sup>1</sup> before, in Cocanadas cotton (*G. arboreum* race. *indicum*). The inheritance of the *short lint*, in crosses effected with two normal linted varieties, *viz.*, Nandyal 14 and Tellapathi and one hairy lintless mutant (*li<sub>s</sub>—li<sub>c</sub>*)<sup>2</sup> from

Nandyal, belonging to the same race, is reported in this paper.

The association between *short lint* and low ginning was perfect and hence the ginning per cent. which was easier to determine and less subject to personal error than staple length was chosen as the phenotypic index to study the nature of segregation in hybrid populations. Possibly, the shortening of the staple length by two-thirds, has the proportionate physical effect of lowering the ginning outturn by an equal amount. It would be therefore more appropriate to view the gene as one affecting metric length than lint density.

The data furnished in Table I reveal the *short lint*—low ginning genotype to be a simple monogenic recessive to 'normal lint'.

TABLE I  
Inheritance of short lint mutant

Nature of material	Total number of plants with		
	Normal lint, having a ginning of 16 to 20%	Short lint having a ginning of 3 to 13%	Value of P (for a mono-factorial ratio)
PARENTS			
(a) CST 1 ..	..	36	..
(b) Nandyal 14 ..	10	..	..
(c) Tellapathi ..	5	..	..
HYBRIDS			
(a) i. CST 1 × Nandyal 14 F 1 ..	32	..	..
ii. F 1 backcross with Nandyal 14 ..	25	..	..
iii. F 2 total of 4 families ..	133	53	0.2
(b) i. CST 1 × Tellapathi F 1 ..	10	..	..
ii. F 2 total of 2 families ..	120	30	0.1

In the cross with Nandyal hairy lintless ( $li_e - li_e$ ), the  $F_1$  was normal with a mean halo length of 22 mm. and a mean ginning value of 4 per cent. The classification in  $F_2$  yielded 129 'normal lint', 63 *short lint* and 35 'lintless' plants agreeing with modified dihybrid ratio of 9:4:3 ( $P > 0.3$ ) for complementary factors.

The symbol  $li_{sh} - li_{sh}$  is now assigned to this new mutant character *short lint* found in Asiatic cotton in accordance with the accepted method of gene symbolisation in cotton. The character is simple recessive to normal lint and epistatic to  $li_e$ . Its relation to other lintless genes remains yet to be worked out. The importance of Coconada zone as a variable centre of origin for cultivated peninsular *arboreums* is strengthened by the discovery of a second new gene affecting lint quantity, but not lint density, the previous one being 'immature lint'<sup>2</sup> which lowers the ginning value by low fibre weight. The 'sparse lint'<sup>1</sup> on the other hand must be viewed as a gene-controlling density.

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September 24, 1951.

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#### FIRE BLIGHT OF COSMOSH— A BACTERIAL DISEASE INCITED BY *ERWINIA COSMOVORA* N. SP.

In August, 1951, a peculiar disease was observed on *Cosmos bipinnatus* Cav. at the Agricultural Institute, Anand. The disease appeared on blossoms, sepals, leaves and twigs. The first visible symptom was the browning of the blossoms and this discolouration extended down to the pedicels. Leaves were discoloured at the margins at first and gradually the entire leaf turned brown. The affected shoots were killed. The dead leaves persisted for quite a long time and gave a charred appearance to the plant.

Sections of diseased material were examined under the microscope and the epidermal cells were invariably found to be full of rod-shaped bacteria. These bacteria were readily obtained in culture and were found to agree entirely in shape and size with those found in the tissues.

The bacteria cause a dry necrosis. This and other symptoms resemble those of fire blight

of pears. The cultural characters of the bacterium, responsible for the disease, are as follows:

Rods, 0.8 to 1.0 by 1.0 to 1.5 microns occurring singly, motile, gram-negative, no endospores, capsules absent, whitish amorphous, gelatin stab; liquefaction confined to upper layers; agar colonies, grayish white, glistening with irregular margins, indole not produced, nitrites from nitrates, acid without gas from glucose, maltose and lactose, no action on sucrose, starch hydrolysed, no action on inulin, it does not grow in absence of organic nitrogen.

From the characters studied above, the bacterium isolated from diseased tissues of *Cosmos* belongs to the genus *Erwinia*. The characters do not conform to any of the species described in Bergey's manual.<sup>1</sup> It is therefore a new species and the name proposed is *E. cosmovora* n. sp.

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October 6, 1951.

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#### FUSARIUM BLIGHT OF CLUSTER BEANS

DURING 1950, a severe epidemic of a peculiar disease appeared on cluster beans (guar), *Cyamopsis psoraloides* D.C. at the Agricultural Institute, Anand. Plants of guar in the adjoining cultivator's fields were also severely affected. The rainfall during the year 1950 was abundant, with an average of 50", while during the year 1951, a total of 14" was recorded. The disease appeared in the beginning of August, 1951, but it did not make any headway as the weather remained extremely dry.

The disease was characterised at the beginning by the appearance of thin black streaks on the stem. These streaks extended downwards and upwards. The pedicels of the leaves were also affected and gradually the affected shoot dried up. No flowers or pods were formed on these shoots. Longitudinal and transverse sections of the affected parts were cut and the fungus mycelium, was invariably observed in the outer parenchymatous tissues.

Very large number of isolations were made from affected tissues and a variety of fungi was isolated. The largest number of isolates belonged to Genus *Fusarium*. There is a good deal of variation among these isolates. Single spore

cultures of various isolates of *Fusarium* were obtained. Seedlings of guar raised in sterilized soil were inoculated with spore suspensions sprayed by means of an atomiser. After the plants were sprayed with spore suspensions, they were kept under moist condition for the next 24 hours. The symptoms of the disease appeared three weeks after inoculation. The strain with which the plants were inoculated, was reisolated from the diseased plants. The fungus which causes the disease belongs to *Fusarium moniliforme* Sheld, according to Wollenweber and Reinking's classification.<sup>1</sup> Its correct name under Snyder and Hansen's system would be *F. moniliforme* Sheld. emend. Snyder et. Hans.

Further work on this disease is in progress.  
Plant Pathological Laboratory, N. PRASAD.  
Agricultural Institute, M. V. DESAI.  
Anand,  
October 6, 1951.

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#### CHITRI DISEASE OF TOBACCO IN GUJARAT

CHITRI disease of tobacco has been recorded by Uppal, Patel and Kamat as a vascular wilt caused by *Fusarium oxysporum* var. *nicotianae* Johns. from the Kaira District in Gujarat. They have considered it to be identical with the wilt of tobacco recorded in U.S.A. Recently Mathrani, Elias and Kadam have studied this disease and have concluded that it is not a typical wilt and that it is probably due to a primary attack of a nematode similar to *Pratylenchus pratensis* (de Man.) Filipjev. This nematode is responsible for brown root rot of tobacco in U.S.A. These authors regard *Fusarium* and *Renzootonia*, isolated from diseased plants as secondary parasites.

We agree with Mathrani, Elias and Kadam that it is not a simple case of wilting but we are not in agreement with their conclusion that *Fusarium* is secondary in nature. As a result of infection studies, conducted over three seasons, we conclude that chitri is a complex of a root rot and wilt. The symptoms of the two types of diseases can be clearly seen in nature and as well as under artificial conditions. Two different species of the genus *Fusarium* are responsible for this complex.

Morphological study of the strains of the casual organisms was carried out and the one

which causes wilt has been identified as *Fusarium oxysporum* f. *nicotianae* and the one which causes root rot is placed under *F. solani* f. *nicotianae*. In the determination of species of *Fusarium*, Snyder and Hansen's classification has been used.

Detailed results of the investigations carried out will be published elsewhere.

Agricultural Institute,  
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November 26, 1951.

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#### ON THE FRY OF THE MILK-FISH *CHANOS CHANOS* (FORSKAL)

It is well known that the fry of the milkfish, *Chanos chanos* (Forskål), appear in large numbers in the tidal flats of the Pamban area, especially near the Chinnapalam Creek. Observations of Delsman<sup>1</sup> (1929), in the Indonesian waters have shown that the fish larvae appear first in the summer months of April and May, and later in the months of September, October and November. The information available on the distribution of *Chanos* fry in different parts of South India has been recently summarised by Ganapathi, et. al.,<sup>2</sup> (1950), and it will be found from the Table published by them that *Chanos* fry have been recorded in most parts of the Madras State only in the summer months with the exception of the Adyar near Madras and Pulicat where they have been recorded also in the October-December periods. In Visakapatnam, *Chanos* fry are recorded up to the September period.

The observations made during the past few years in the Pamban area have not revealed the presence of *Chanos* fry in months other than April-June and it is interesting to note that on 28th November, 1951, the fry of *Chanos* were observed by us in the Chinnapalam Creek in sizes as small as 15 mm. which represent some of the earliest stages of the fry recorded in Indian waters. Fry have continued to be available for many succeeding days. While the possibility of their occurrence in the autumn months is always kept in mind as it will prove to be of great value in the culture of the milkfish, it is noteworthy that throughout the Indian coast the summer months of April-June appear to be

the principal period for them. Schuster's<sup>3</sup> (1951) record of young *Chanos* in Kalpitiya is also in conformity with this observation. This is very different from the behaviour of this species in Indonesian waters where the September-November period has been found to be more important.<sup>1</sup> It may also be added that on 16th October 1951, we obtained what is probably the first recorded adult specimen of *Chanos* from the Gulf of Manaar, which had a total length of 1,240 mm. and had spent ovaries. During the last summer months it was also possible for us to extend the places of fry collection in this area to the shores of Palk Bay in the direction of Mandapam to Theedai where the fry enter the saline lagoons adjoining Palk Bay in large numbers.

Based on ova diameter measurements, Bunag<sup>4</sup> (1951) has shown that *Chanos* has only one spawning season in the Philippines. In the adult *Chanos* we have examined, the ovaries are in a completely spent condition and do not indicate the possibility of protracted spawning as no part of the ovary was showing active growth of the oocytes indicative of a secondary spawning. It is possible, therefore, that so far as individual fish are concerned, there is only one spawning during the year but that the spawning period for the species is not limited to a very short period in terms of summer or autumn months. It is noteworthy, however, that there is a pronounced discontinuity in the occurrence of fry between their first appearance in the summer months and their later appearance. The Table given by Ganapathi, *et. al.*, would give the impression that in the various places the fry might occur for the April to October period, but it is not clear whether these authors have differentiated between the appearance of early stages of the fry and of the availability of the fingerlings. More information on the initial appearance of the larvae in various regions of the coastline at different times of the year is essential for a further understanding of the habits of the fish. It is needless to add that, if a definite secondary period of spawning could be established, it is of considerable importance for the future development and expansion of milkfish culture.

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Mandapam,                      R. VISWANATHAN.  
December 9, 1951.

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# MICROSPOROGENESIS AND MALE GAMETOPHYTE IN *ELEUSINE* *CORACANA* GAERT.

IN the course of an investigation on the embryology of the millet *Eleusine coracana* Gaert., certain observations were made on the development of the pollen which seem worthy of record.

The anthers are bisporangiate and quadriculocular in cross-section. The pollen mother cells are surrounded by a glandular tapetum of binucleate cells, a middle layer which gets obliterated at an early stage, an endothecium developing fibrous thickenings and an epidermis containing attenuated cytoplasm and nuclei, when mature.

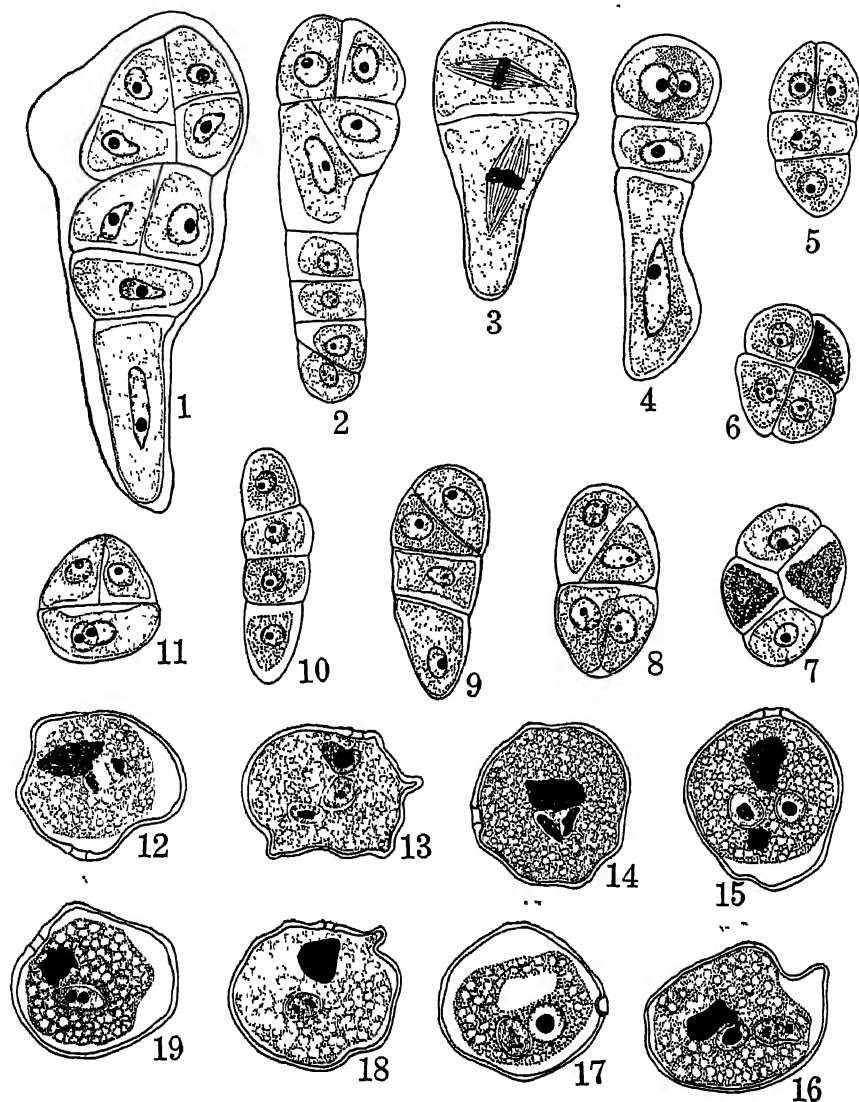
The pollen mother cells round up prior to meiosis and the divisions are of the successive type. Usually the tetrads are isobilateral or tetrahedral in arrangement. But linear (Fig. 10), decussate (Fig. 11), and T-shaped (Fig. 5), tetrads are also frequently formed in the same loculus. The occurrence of all the above five types of dispositions of the microspores in one and the same species has not been reported hitherto in any of the grasses though recorded for certain monocots like *Musa*,<sup>1</sup> *Habenaria*<sup>2</sup> and *Ottelia*.<sup>3</sup>

In a few cases, less than four microspores are formed. This may be due to the failure of Division II in one of the dyad cells, or one or sometimes two microspores of a tetrad become non-functional and degenerate *in situ* (Figs. 6 and 7). Generally the microspores of a tetrad are of a similar size and shape; but in some cases marked size differences are noticeable. One or two spores may be smaller or one may be considerably elongated than the others (Fig. 4). This is so especially in the T-shaped tetrads. The pollen mother cells destined to give rise to these tetrads can be spotted even at early prophase, for instead of rounding prior to meiosis, such cells become elongated and swollen at one end so as to present a club-shaped appearance. The nucleus of the mother cell occupies the swollen end and the first meiotic

1. Delsman, H. C., "Fish eggs and larvae from the Java Sea. 13. *Chanos chanos* (Forsk.)," *Treubia*, 1929, 11,

sion results in two dyads of unequal size.  
3 shows division II in such dyad cells.  
In still others oblique wall formation occurs  
the completion of meiosis II resulting in an

Usually the tetrads are free from one another  
when formed, but sometimes they show a ten-  
dency to remain united. Thus two tetrads may  
remain closely appressed to each other result-



FIGS. 1 and 2. Union of two tetrads showing dissimilar arrangement of microspores ;  
FIG. 3. Division II in dyad cells ; FIGS. 4 and 5. T-shaped tetrads : note size  
differences of microspores in Fig. 4 ; FIGS. 6 and 7. Tetrads showing degeneration of  
either one or microspores ; FIGS. 8 and 9. Tetrads showing oblique wall formation  
between microspores in the upper dyad ; FIGS. 10 and 11. Linear and decussate tetrads.  
FIG. 12. Division in generative cell ; FIG. 13. Three-celled pollen grain ; FIG. 14.  
Pollen grain at shedding : note the degenerated tube nucleus ; FIGS. 15 and 16. Pollen  
grains showing more than three nuclei ; FIGS. 17 to 19. Generative cell undergoing  
division without cell plate formation.  $\times 715$ .

lateral tetrad consisting of microspores of  
different sizes or only one of the dyads may  
an oblique division (Figs. 8 and 9).

ing in an association of eight cells. Such a con-  
dition probably arises from the development of  
two pollen mother cells lying in close juxta-



position without separation. Variations in the arrangement of the microspores in such twins are also noticed. One may have a tetrad of one type and another of a different type (Figs. 1 & 2), or both may show similar arrangements.

To sum up, a somewhat striking parallelism is seen in the behaviour of the pollen mother cells and the megaspore mother cells not only in the formation of the various kinds of spore tetrads but also in the non-functional character of some of the spores of a tetrad.

The pollen grains are three-celled at the time of shedding (Figs. 12 to 14). The vegetative nucleus is always found in an advanced stage of degeneration and takes a deep stain. Occasionally, however, supernumerary nuclei are observed in the pollen grain. These can arise from divisions of either the vegetative or the generative nucleus (Figs. 15 & 16). A similar condition occurs in *Sorghum vulgare*<sup>4</sup> and in other grasses like *Panicum* and *Paspalum* (author's unpublished observations).

A new feature is that during the division of the generative cell the two chromosome sets may move apart to the poles without the formation of an intervening cell plate. Such cells show two nucleoli of equal size lying side by side within a common nuclear membrane (Figs. 17 to 19). It further appears that there may be no strong metaphase contraction of the chromosomes so that the resulting nucleus is diploid in constitution. The phenomenon is intranuclear and suggests a type of endoduplication of the chromosomes as recorded in the tapetal cells of *Spinacia*.<sup>5</sup> The formation of such cells, though sporadic, may be seen in the same loculus along with the normal pollen grains.

I am not aware of the occurrence of similarly originating and apparently diploid male gametes in other plants. Fertilization of a haploid egg through functioning of such a diploid male gamete may be one of the methods of origin of autotriploids such as have been recorded in *Saccharum spontaneum* and *Penisetum typhoides*, although usually they are believed to arise either by a fusion of two male gametes with the egg or due to non-reduction during meiosis.

My grateful thanks are due to Prof. P. Maheshwari for kindly going through the slides and for many helpful suggestions in the preparation of this note.

Dept. of Botany, S. NARAYANASWAMI.  
University of Delhi,  
Delhi,  
October 4, 1951,

1. Juliano, J. B. and Alcala, P. E., *Philippine Agr.*, 1933, 22, 91-126.
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#### MAGNETIC STORM EFFECTS ON THE F-LAYER OF THE IONOSPHERE

THE effect of magnetic storms on the ionosphere has been studied by the pulse method at vertical incidence by several workers,<sup>1,2</sup> particularly by Wells, Watts and George and Lindquist. These investigations show the existence of ionic clouds in the F-layer of the ionosphere moving in and out rapidly with velocities of the order of 1 to 2 km./sec. Evidence of the existence of such ionic clouds in the F-layer is obtained during a study of the fading patterns of the shortwave signals during periods of magnetic disturbances and particularly during the magnetic storm on March 7, 1951, when a storm of moderate severity was reported by observatories<sup>3</sup> all over the world [Kodaikanal reported international character Fig.-2]. The fading records obtained are chiefly of the AIR transmission from Madras on a frequency of 9,590 kc./s. from 1300 hrs. to 1500 hrs. I.S.T. The transmitter-receiver (Madras—Waltair) distance is 600 km. During this period the propagation is via the F-layer.

Below is reproduced the fading record obtained on the 7th March between 1300 hrs. to 1500 hrs. which shows a type of fading that is not observed on normal days. The record shows a periodic and violent fading. Closer examination, however, reveals some interesting features. As is seen, the frequency of fading is 2 to 3 cycles per minute at the beginning of the record, and this increases gradually to a value of the order of 60 c.p.m. and greater, in about 13 minutes. This sequence is, however, then reversed and the cycle repeated. In fact, in the 2-hour record this occurred 4 times. The very close similarity between the sequences is remarkable.

The presence of the ionic clouds in the F-layer during a magnetic storm produces rapid and sudden changes in F-layer ionisation and heights and the F-layer is in a state of turbulence.<sup>1</sup> If then a radio wave is incident on the F-layer this will experience Doppler fading at the point of reception as the "point" of reflection in the F-layer will be subject to oscillation

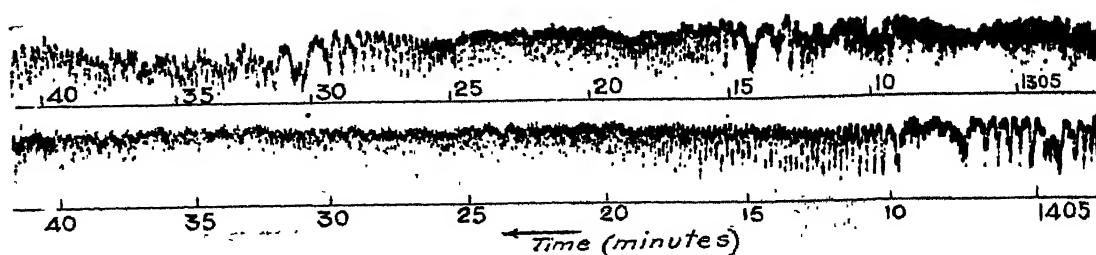


Fig. 1. Record of the fading pattern of A. I. R. Madras transmissions on 9590 kc/s., from 13<sup>h</sup>00<sup>m</sup> to 15<sup>h</sup>00<sup>m</sup> I. S. T. obtained during the magnetic storm on March 7th, 1951.

in a vertical sense owing to the sudden and rapid changes in the vertical gradient of ionisation. The fading reported here, though it resembles the Appleton-Beynon fading,<sup>4</sup> is not due to interference between the magnetoionic components but is to be ascribed to the undulations of the point of reflection at the F-layer. The sequence of the change in fading frequency is then to be attributed to a drift in the mean position of the point of reflection. This may be produced by F-layer turbulence of larger scale or a gradual change in the layer height. Thus an increase in the fading frequency indicates a downward motion of the layer while a decrease indicates an upward movement. Ionic clouds in the E-layer may have some effect on the period of fading but these alone cannot account for the observed fading. Complete details will be published shortly.

The author wishes to record his grateful thanks to late Dr. N. S. Subba Rao for his kind interest in the author's work. His thanks are also due to Prof. K. R. Rao for giving the necessary facilities and to Dr. A. K. Das, Director, Solar Observatory, Kodaikanal, for furnishing the necessary data on magnetic and solar activity.

Wireless Research Lab., Y. V. SOMAYAJULU.  
Physics Department,  
Andhra University,  
Waltair,  
October 29, 1951.

1. Wells, H. W., Watts, J. M. and George, D. E., *Phys. Rev.*, 1946, **69**, 540. 2. Lindquist, R., *Archiv. f. Geophys.*, 1951, Band I, No. II, 3. —, *Journal of Geophysical Research*, 1951, **56**, (2), 289. 4. Appleton, E. V. and Beynon, W. J. G., *Proc. Phys. Soc.*, 1947, **59**, 58.

### iodoform reaction with jute cellulose

A VARIETY of organic compounds originally containing no keto groups yield haloform when treated with halogen and alkali under specified conditions.<sup>1,2</sup> Huebner and Sinha<sup>3</sup> first obtained iodoform from cellulosic materials, silk, wool

and rubber, etc., by treatment with iodine and 17.5% NaOH followed by steam distillation.

In the course of some experiments here on the absorption of iodine by jute cellulose and cotton from KI solution, in presence of alkali, iodoform was smelt in the reaction mixture, after titration of the available iodine with thio. This obviously suggested that cellulose was oxidised by iodine, with scission of the chain, even in the mild conditions, to give the iodoform reaction. A little of the cellulosic material—jute fibre, holocellulose, alphacellulose and hemicellulose, was taken in a stoppered conical flask, covered with dilute solution of iodine (N/50) in KI and NaOH (N/2) added drop by drop, till the colour and odour of iodine were discharged on thorough shaking, and kept for sometime at ordinary temperature. The characteristic and unmistakable smell of iodoform was perceptible. The contents of the flask were shaken with a few drops of aniline, warmed and kept for a while. The offensive smell of carbylamine confirmed iodoform. The same results were obtained by the use of KI and NaOCl, and with glycerine and starch paste. Iodoform reaction with holocellulose, using NH<sub>4</sub>OH instead of NaOH, was also positive. This shows according to Schwinkler reaction<sup>4</sup> (formation of iodoform in presence of ammonium hydroxide) that one of the products of oxidation of cellulose by iodine, even under mild conditions, is a compound containing CH<sub>3</sub>-CO-C-group. AR chemicals were used in the experiments. Details will be published elsewhere.

Thanks are due to Dr. P. B. Sarkar, Director, for his interest in the work.

Technological Res. Labs., H. CHATTERJEE,  
Indian Central Jute Committee,  
Tollygunge,  
Calcutta 33,  
November 5, 1951.

1. Slotta and Neisser, *Ber.*, 1938, **71B**, 1611. 2. Kratzl, *et al.*, *C.A.*, 1950, **44**, 325. 3. Huebner and Sinha, *J. Soc. Chem. Ind.*, 1923, **42**, 255T; *Ibid.*, 1922, **41**, 93T. 4. Edwin Rothlin, *C.A.*, 1941 **35**, 5091,

## REVIEWS

**Mathematical Engineering Analysis.** By R. Oldenburger. (Macmillan & Co., New York), 1950. Pp. ix + 426. Price \$6.

The book under review is quite unique in the field of engineering mathematics and will be of great use to engineers and industrial physicists interested in expressing physical situations mathematically. It is made up of five parts: Mechanics of Rigid Bodies, Electricity and Magnetism, Heat, Elasticity and Fluid Mechanics. In each of these, the fundamental theory is set out clearly in mathematical form and with this as background, physical problems in different branches of engineering are treated mathematically. The solution of these physical problems is then illustrated by making simplified assumptions. Problems are presented at the end of each section so that the reader might obtain practice in setting up physical systems in mathematical form.

This book can be ideally used as a text-book on engineering analysis by students with a knowledge of advanced calculus and will be indispensable to everyone engaged in industrial research and also to mathematicians interested in obtaining an acquaintance with the fundamental concepts of engineering.

A. R.

**Machine Shop Mathematics.** By Aaron Axelrod. Second Edition. (McGraw-Hill), 1951. Pp. xi + 359. Price \$3.60.

The complexity of modern industry makes very exacting demands on the technical knowledge of the skilled mechanic. A good grounding in arithmetic, algebra and trigonometry is one such; and the book under review is intended to present aspects of these branches required by machine shop students and apprentices and also related information on machines, attachments, tools, metals and shop procedures. It is extremely self-contained and the practical aspects are always kept to the forefront. The book starts from simple arithmetic such as fractions, weights and measures, etc., but leads up to various results in geometry and trigonometry, such as solution of triangles, and various geometrical constructions. The last four chapters deal with speeds and feeds in various machines, lathe work such as cutting tapers, screw threads and worms, cutting gears of

various types and finally milling machine work. However, there seems to be no mention of dividing machines and methods of graduating scales and constructing verniers; but this is only a minor omission. It is to be hoped that machine shop apprentices in our country would be given as thorough a grounding in mathematics as is presented in this book, and it can therefore be warmly recommended to all instructors in workshops. The book is moderately priced, considering the quality of the contents and the excellent printing and get-up.

**Partial Differentiation.** By R. P. Gillespie, (Oliver and Boyd), 1951. Pp. viii + 105. Price 6 sh.

This booklet is a new addition to the University Mathematical Texts edited by Aitken and Rutherford. It is comparatively elementary and forms an introduction to the subject of partial differentiation to those familiar with the differentiation of functions of a single variable. The first chapter contains a definition of a partial derivative and the conditions for its existence. This is followed by a chapter on change of variable, the Jacobian, Hessian, Partial and Complete Differentials, etc. The third chapter deals with Taylor's theorem for a function of several variables and its applications to curves and surfaces. The final chapter is devoted to problems of maxima and minima in functions of  $n$ -variables. In particular, it includes an account of Lagrange's method of undetermined multipliers, which finds application in various types of problems. The book contains also a number of examples for being worked out. It will be found useful by students who wish to get acquainted with methods of partial differentiation.

**Photosynthesis and Related Processes.** Vol. II, Part I. By Eugene I. Robinowitch (Interscience Publishers Inc., New York), 1951. Pp. xi + 603 - 1,208. Price \$15.

Part I of the second volume on photosynthesis compiled by the author deals with the spectroscopy and fluorescence of photosynthetic pigments and kinetics of photosynthesis. Ever since the classical researches of Willstätter and Stoll on leaf pigments and their relation to carbon dioxide assimilation, there has been so rapid

an advance in our knowledge on this aspect of photosynthesis that it has changed the outlook of the whole field of this problem. A very extensive literature containing some very conflicting results has now accumulated on the absorption spectra of pigments, the light absorption by pigments in a living cell and the fluorescence of pigments *in vivo* and *in vitro*. The author has summarised the numerous findings in a concise and critical manner.

The remaining portion of the book deals with the kinetics of photosynthesis and the three chapters on light factor make a very illuminating reading. They produce a vivid picture of the complex nature of the process which was illustrated thirty years ago by the simple equation that carbon dioxide and water in the presence of sunlight were converted into carbohydrates. Though we are still far from understanding how such transformation is effected in a living cell, very useful knowledge has already been gained.

The book is intended to give useful guidance to those who wish to tackle any aspect of this all-important process. It is also well illustrated. The author has rendered a great service in presenting in a very able manner the up-to-date information on photosynthesis.

R. H. DASTUR.

**Evolution.** By A. Franklin Shull. (McGraw-Hill Book Company Inc., New York, Toronto & London), 1951. Second Edition. Pp. vii + 322. 141 Text-figures. Price not mentioned.

The first edition of Shull's *Evolution* was written about a decade and a half ago and attempt was then made to give a general account of evolution resting on a genetic background. Its scope was then limited practically to the evolution of animals, but this omission has been set right in the 2nd edition. An account of polyploidy is now also given.

Though, to some extent, this book can be helpful to the trained biologist, it is primarily written for students. For this reason, chapters giving the classical types of evidence for students are included so that they should know why evolution has happened and why it is now believed to be a fact by a majority of the people. Though these evidential chapters have also been moderately changed in the 2nd edition, the author has practically rewritten the rest of the book and nearly three-fourths of the illustrations are new. Throughout the revised edition also the author has always kept genetics everywhere in the forefront.

The author has given a brief history of the idea of evolution in the first chapter and towards the end, in the chapter on organization of human and other animal societies. The "Origin of Life" is the subject-matter of the last chapter.

The author has avoided bibliographies, as citations of research articles and names of authors, from the student's point of view, may give the book a choppy appearance. There is, however, a good subject-index, covering 24 pages, at the end and this provides an analytical key to the whole work.

Though the reviewer does not believe in laying so much emphasis on genetics as an explanation for evolutionary processes and is, in fact, himself a believer in the adaptiveness of living things, he has found the work very useful for a general grasp of the intricate theories of evolution and for understanding the modern trends in studying them. The work can be specially helpful to students who have yet to be initiated in the study of general biological phenomena.

S. L. H.

**Alcohol—A Fuel for Internal Combustion Engines.** By S. J. W. Pleeth. (Chapman & Hall), 1945. Pp. xv + 259. Price 28 sh. net.

The problem of suitable liquid fuels for internal combustion engines has attained urgent importance in the face of the discouraging fact that our reserves of the two well-known and irreplaceable sources of fuel—coal and petrol—are getting depleted at an alarmingly rapid rate. The fuel consumption for 1950 is estimated to exceed 400 million tons and the imperative need for exploring alternative sources of fuel has arisen.

Alcohol—known to man for ages in the form of fermented liquors—offers prospects of constituting an ideal source of a perennially renewable fuel. This source would last as long as the sun continues to shine and the chlorophyll plants capture sun's energy and store it in the form of carbohydrates. There are tremendous possibilities of augmenting the world's production of alcohol.

The seventeen chapters which comprise the present volume are devoted to a critical and clear presentation of this potential and replaceable source of liquid fuel for various types of internal combustion engines. There is a very useful discussion (Chapter V) on the important subject of knock. Detailed analysis of the fuel requirements of motor cars, racing cars and aeroplanes are presented in a series of three

chapters (6, 7 and 8). The ninth chapter deals with water-tolerance of alcohol while the tenth gives some of the important properties of alcohol pertinent to its status as a fuel, *e.g.*, calorific value, volume changes on blending, spontaneous ignition temperature, flash point, etc. Illumination data on cylinder wear, corrosion and gum formation, are given in the succeeding three chapters.

There have been many unfavourable reports repeatedly levelled against alcohol as a fuel,—mostly from powerful interests who own or control rich oil deposits. Countries which have little or no oil, have favoured alcohol as a fuel. The author of this volume has presented “the case for and against alcohol in general terms” in the light of the experience gained in many countries. He has shown how the conclusions have been influenced by political and economic considerations. The last chapter on planning for the future makes interesting and instructive reading. The author is an enthusiastic advocate of alcohol, whose production would subsidise and enrich agriculture. For an agricultural country like ours, whose oil resources are poor, this volume has a special appeal. This is a book which should be widely read not only by those interested in the subject of alcohol as a fuel but also by the economists and the administrators interested in the economic regeneration of this country.

**The Enzymes, Chemistry and Mechanism of Action.** Vol. I, Part I. Edited by James B. Sumner and Karl Myrbäck. (Academic Press Inc., New York), 1950. Pp. xvii + 724. Price \$13.50.

Enzymology occupies a strategic and pivotal position in the domain of biological sciences. All vital phenomena associated with the living cell are largely mediated and controlled by enzymes. There have been continued, intensive and many-sided attempts at an understanding of the chemical nature of these intriguing entities in relation to their catalytic function; the results so far obtained, while illuminating many aspects of the problem, have added little to a clarification of their structure and mechanism and specificity of their action. In recent years, the new techniques and instruments which have been developed have been pressed into service for elucidating the problem and there has been enormous output of research achieved in this field.

The editors of this monumental series of volumes, both distinguished for their brilliant

contributions to enzymology, have taken upon themselves the difficult task—“to gather and sift available knowledge, present it in an orderly fashion and try to utilise it for the advancement of enzymology”. Their commendable aim is “to present systematically the accumulated knowledge in the various phases of enzymology as a comprehensive survey which will be of the most efficient service both to those already working in the field and to those preparing to enter it”. In the successful accomplishment of this endeavour, the editors have been able to secure the co-operation of seventy-eight of their colleagues—each an authority on the subject concerned.

The series has been planned to be issued in two volumes, each volume consisting of two parts. The volume under review consists of 19 chapters covering (1) Introduction by James Sumner and Karl Myrbäck, (2) The Physical Chemistry and Chemical Kinetics of Enzymes, by E. A. Moelwyn Hughes, (3) Enzyme Specificity, by Burkhardt Helferich, (4) Enzymes in Relation to Genes, Viruses, Hormones, Vitamins and Chemotherapeutic Drug Action, by M. G. Sevag, J. S. Gots and E. Steers, (5) Cytochemical Foundations of Enzyme Chemistry, by A. L. Dounce, (6) Modern Aspects of Enzymatic Adaptation, by S. Spiegelman, (7) Enzyme Inhibition, by L. Massart, (8) Enzymes and Immunology, by J. R. Marrack, (9) Enzymes. Hydrolysing Fats and Esters, by R. Ammon and Maire Jaarma, (10) Acetyl Choline Esterase and Choline Esterase, by Klas-Bertil Augustinsson, (11) Phosphatases, by Jean Roche, (12) Metaphosphate and Its Enzymatic Breakdown by Bjorn Ingleman, (13) Sulphatases, by Claude Fromageot, (14) Invertase, by Carl Neuberg and Ines Mandl, (15)  $\alpha$ -D-Glucosidases, by A. Gottschalk, (16)  $\beta$ -Glucosidase, by S. Veibel, (17) Hydrolysis of Galactosides, Mannosides and Thioglycosides, by S. Veibel, (18)  $\beta$ -Glucuronidase, by W. H. Fishman and (19) Amylases and Hydrolysis of Starch and Glycogen, by K. Myrbäck and G. Neumüller.

It will be seen that the first eight chapters are devoted to a discussion of the general aspects of enzymology. The succeeding chapters deal specifically with some of the individual enzymes. The editors have not been able to consider it either “necessary or even appropriate” to include a comprehensive survey of practical methods used in enzymology. It is, however, felt that a third volume devoted to a discussion of the practical methods would add

greatly to the usefulness and completeness of this remarkably well-conceived and ably executed series of volumes on enzymology.

**Styrene.** By A. L. Ward and W. J. Roberts. Edited by E. R. Blout and H. Mark. (Interscience Publishers, Inc., 250, Fifth Avenue, New York 1, N.Y.), 1951.

The monograph is a revised and enlarged edition of the previously published section on Styrene, in the Monomers series. It begins with brief chapters on the preparation of the monomers, their laboratory as well as commercial, purification from impurities, by-products, analysis and methods of handling them. Data from recent literature on the physical, chemical and thermodynamic properties of styrene have been given. The chapter on polymerization and copolymerization will serve as a useful guide to any one working in this field. Particular attention has been paid to copolymers that have commercial values. The monograph also contains a report of recent work on copolymers produced by mass polymerization, solution polymerization and emulsion polymerization.

The bibliography is comprehensive and includes 201 references, most of which refer to latest literature.

The monograph has been admirably written and will serve as an excellent supplement to the Monomers Series.

M. S. MUTHANNA.

#### Books Received

*Elsevier's Encyclopædia of Organic Chemistry.* Series III, Vol. 14, Supplement. Edited by

F. Radt. (M/s. Elsevier's Publishing Co., London, W.1), 1951. Pp. xxxi + 938. (Index 113). Price not given.

*Advanced Five-Figure Mathematical Tables.* By C. Attwood. (M/s. Macmillan & Co. Ltd.), 1951. Pp. v + 69. Price 4 sh. 6 d.

*Advances in Genetics*, Vol. IV. Edited by M. Demerçé. (M/s. Academic Press Inc.), 1951. Pp. ix + 343. Price \$7.50.

*Sound Insulation and Acoustics.* By Per V. Bruel. (M/s. Chapman & Hall), 1951. Pp. xii + 275. Price 35 sh.

*Experimental Spectroscopy.* Second Edition. By R. A. Sawyer. (Chapman & Hall), 1951. Pp. x + 358. Price 30 sh.

*Nomographic Charts*, First Edition. By C. Albert Kulmann. (M/s. McGraw-Hill Book Co.), 1951. Pp. xii + 244. Price \$6.50.

*Physiology of the Fungi*, First Edition. By Virgil Greene Lilly and Horace L. Barnett. (M/s. McGraw-Hill), 1951. Pp. xii + 464. Price not given.

*Bacterial Physiology.* By C. H. Werkman and P. W. Wilson. (M/s. Academic Press), 1951. Pp. xiv + 707. Price \$8.50.

*Vitamins and Hormones* (Advances in Research and Applications), Vol. IX. By Robert S. Harris and Kenneth V. Thimann (Editors). (M/s. Academic Press), 1951. Pp. xii + 395. Price \$8.00.

*Further Laboratory and Workshop Notes.* Edited by Ruth Lang. (M/s. Edward Arnold & Co.), 1951. Pp. xii + 290. Price Rs. 28.

## SCIENCE NOTES AND NEWS

### *Ophioglossum vulgatum*

Sri. A. S. Mehta, Dept. of Botany, Science College, Patna, writes as follows:

Several specimens of *Ophioglossum vulgatum* L. were collected from Purnea (Bihar), and this constitutes yet another record of its occurrence. The specimen differs from other reported materials of the same species in possessing 2 to 4 leaves on the rhizome. The maximum number of leaves recorded upto now is 3. None of the specimens shows a monophyllous habit.

### Indian Phytopathological Society

The following were elected to the Council for the year 1952:

*President*: Dr. B. B. Mundkur, Poona; *Vice-President*: Dr. R. P. Asthana, Nagpur; *Councillors*: Dr. A. P. Misra, New Delhi; Dr. P. R. Mehta, Kanpur; Prof. S. R. Bose, Calcutta; Dr. M. L. Gattani, Bharatpur; Dr. M. K. Patel, Poona and Mr. K. M. Thomas, Mysore State; *Secretary-Treasurer* (1950-52): Dr. R. Prasada, New Delhi.

### Indian Botanical Society

The following Office-bearers have been elected for the year 1952:

*President*: Dr. K. Biswas, Calcutta; *Vice-Presidents*: Dr. P. Maheshwari, Delhi, and Dr. R. K. Saxena, Allahabad; *Hon. Secretary*: Dr. R. Misra, Sagar; *Treasurer*: Dr. R. L. Nirula, Amraoti; *Editor-in-Chief*: Dr. A. C. Joshi, Jullundur City; *Business Manager*: Dr. T. S. Sadashivan, Madras.

### Burmah-Shell Scholarships

In recognition of the work done by the CSIR during the war, particularly in connection with the utilization of vegetative oils as lubricants, the Burmah-Shell have offered an annual donation of Rs. 1 lakh to be divided as follows:

- (1) Rs. 50,000 per year for Scholarships at Loughborough College in the U.K. The proposal is to provide means of sending to U.K. two students a year at an approximate cost of £ 450 each, so that from the 4th year onwards there will always be 8 students a year in the U.K.
- (2) Rs. 50,000 a year for open research scholarships to the Commonwealth, the planning and operation of the scheme to be in the hands of the Ministry of N. R. and S. R. in collaboration with Burmah-Shell.

The Burmah Oil Company have also offered a donation of Rs. 1 lakh per annum to be applied to the granting of scholarships to young men wishing to go to the U.K. for scientific and technical training aimed at fitting them for posts in industry, especially that relating to oil in India.

### Ford Grant to Pakistan

A grant of \$ 1,600,000 to set up a Polytechnic Institute and a Domestic Science College in Pakistan has been made by the Ford Foundation.

### Trade Name Index of Industrial Diamonds

The Industrial Diamond Information Bureau and the Industrial Diamond Review have compiled a highly useful index of industrial diamonds for the year 1951-52. Copies can be had at 3 sh. 6 d. each from the publishers: N. A. G. Press Ltd., 226, Latmyer Court, Hammersmith, London W. 6.

### Symposium on I. C. Engines

A Symposium on Problems in the Development of Internal Combustion Engine Industry in India is to be held under the joint auspices

of the Internal Combustion Engines Research Committee of the Council of Scientific and Industrial Research and the Indian Institute of Science in Bangalore for two days about the end of March 1952.

The Committee intend publishing the papers presented at the Symposium in the form of a monograph. Intending contributors are requested to send their papers with a short abstract before 1st February, 1952, to S. N. B. Murthy, Secretary, Internal Combustion Engines Research Committee, c/o The Director, Indian Institute of Technology, 5, Esplanade East, Calcutta 1.

### Out-of-Print Periodicals

Information can be had from the Libraries Division of the Science Co-operation Office, New Delhi, regarding the availability of periodicals which have been out-of-print, but which have now been reproduced in printed, microfilm or microcard form. This list does not include titles of periodicals microfilmed and held by libraries for which the right of reproduction and sale is not also held. Also readers are requested to send to the Libraries Division of UNESCO the titles of periodicals which they know to be out-of-print and for which there is a long-felt need. It may be possible for UNESCO to arrange to have such out-of-print issues reproduced and made available.

### Edible Casein from Spoilt Skim Milk Powder

The Central Food Technological Research Institute, Mysore, has developed a simple and inexpensive process for the manufacture of edible casein from spoilt skim-milk powder. It is estimated that a ton of milk powder can be processed to yield about a third of its weight of good quality casein, at a cost roughly of Rs. 400.

### Award of Research Degree

On the recommendation by an Examiners' Board consisting of Prof. M. L. Olephant, F.R.S., Prof. Sucksmith, F.R.S., Prof. E. J. Bowen, F.R.S., and Prof. H. J. Taylor, the Degree of Doctor of Philosophy in Physics of the Banaras Hindu University was conferred on Mr. B. R. Marathe for a thesis entitled "Studies of Joshi Effect Near Threshold Potentials".

### CORRECTION

Vol. 20, No. 12: In the article on "Metabolic Interrelationships between Folic Acid and Vitamin B<sub>12</sub>," the values for urinary N'-methyl nicotinamide (Table II, p. 320) should be in *gammas* and not in mg.

## ANNOUNCEMENT

### JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH

To accommodate the large number of original research papers coming in for publication and to facilitate speedy publication of such papers, the number of pages in the Journal has been increased from 64 to 100 from January, 1952.

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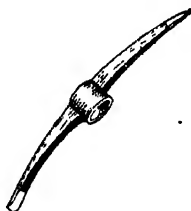
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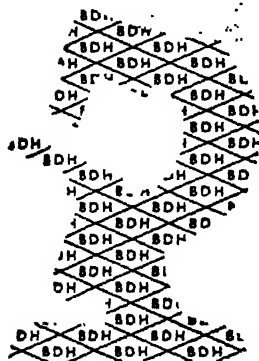
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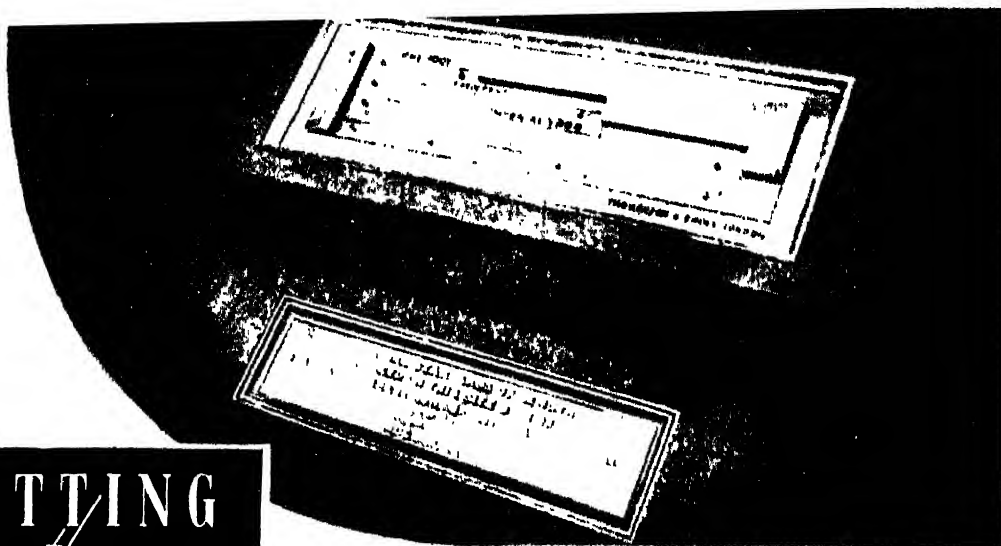
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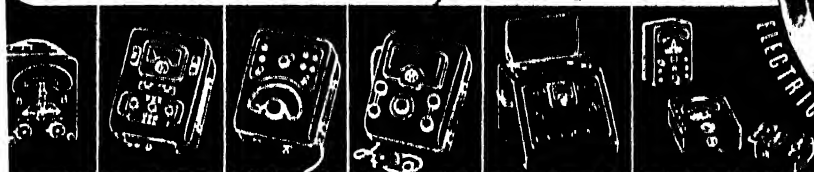


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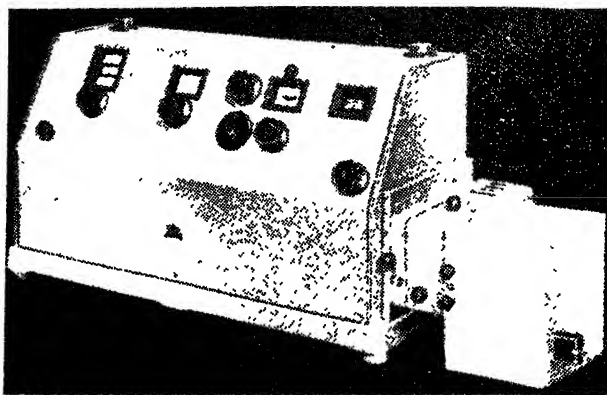
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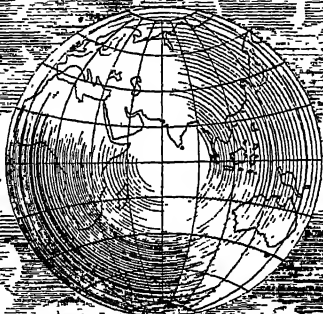
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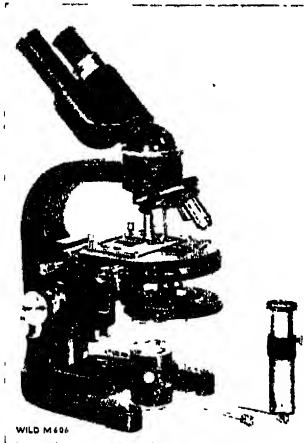
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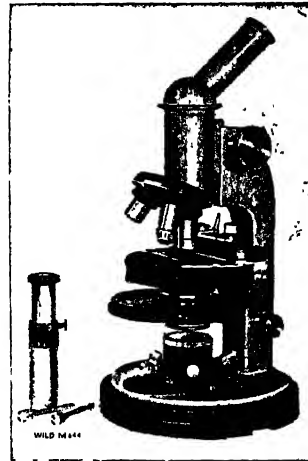
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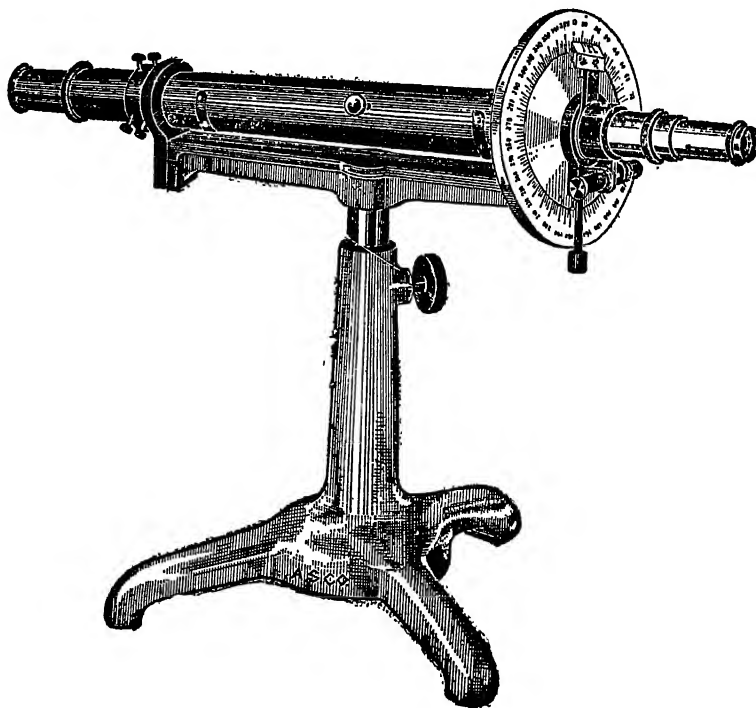
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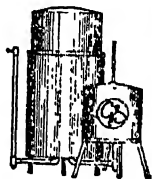
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## POSSIBILITIES OF FURTHER EXPANSION OF FISH AND PRAWN CULTURAL PRACTICES IN INDIA

ONE of the geographical peculiarities of India lies in the existence of vast low-lying areas along the entire coastline both on the East and West Coasts, although they tend to occur more extensively on the East Coast. As these areas are saline they are unfit for agricultural purposes. Soon after the monsoons these get inundated with a few feet of rain water and in addition, tidal water often comes in from the sea, either trickling over the sand bars or through temporary connections established with the sea during the monsoon months. The water in them is invariably saline, but the salinity is subject to a great deal of fluctuation from about 5 to 50 parts per mille, the higher values being observed during the summer months. Towards the end of summer the salinity further increases; patches of water get isolated and the shallower ones dry up; some of the remaining deeper pools contain waters so highly saline as not to support any appreciable amount of life with the exception of halophilic blue green algae and bacteria. These extreme conditions of

drought are not observed on the West Coast which is served by both the South-West and North-East Monsoons.

It is obvious that if these areas can be developed so as to be available for food production they would make a substantial contribution to the food resources of the country. A good proportion of them is capable of being developed into marine fish farms of the type found in some parts of Italy and Southern France for the cultivation of marine fish, principally mullets. The suggestion was first made by Hornell,<sup>1</sup> but no active steps have been hitherto taken; most species which he considered suitable cannot now be recommended for culture. Fortunately, we are not lacking in other suitable species since many of the mullets (*Mugil* spp.) and the milk-fish (*Chanos chanos*) found on the Indian Coast can withstand wide salinity changes.<sup>2</sup> Physiologically, what would be ideal are species which prefer low salinities in their younger stages and as growth proceeds, prefer progressively higher salinities. Species chosen

for fish cultural purposes should in addition be such as would benefit from the primary food cycle of waters or, in other words, should be algal, vegetable or detritus feeders so that they will not have to be dependent on other animals for food. Many of these advantages are combined in *Chanos chanos*, the fry of which appear in considerable numbers in certain parts of the Indian Coast, particularly in the Pamban area in the months April-June. As *Chanos* fry can be stocked in inland waters and grown to marketable size, there is urgent need to expand the fry resources by locating more centres from where the fry could be secured. At the present time the supply is much less than the demand. The available information on the occurrence of *Chanos* fish-seed in S. India has been recently summarized.<sup>3</sup> The main season for fry is during the drought period but this drawback will cease if an auxiliary season is generally prevalent as has been recently suspected.<sup>4</sup>

For the proper utilization of the coastal shallow tracts for *Chanos* or mullet culture, permanent reservoirs of water should be formed by excavation, bunding and by the provision of sluice gates connecting them through feeder canals with the sea so that water could be allowed in as required. The coastal tracts are extensively developed into salt-water ponds or 'tambaks' in Indonesia where *Bandæng* or *Chanos* culture has been developed into a highly specialised fish cultural practice.<sup>3,4</sup> Where tides are not strong, pumping devices are employed in that country. So far as India is concerned, development of marine fish farms is a distinct possibility which should be explored by carrying out preliminary trials in selected areas. Rao<sup>7</sup> has estimated the available area for this purpose at 2,000 square miles and has computed an annual production of about 500 lb. per acre at an estimated initial cost of Rs. 10,000 per square mile; it is clear that fish production even at half the above figures per acre would be a major contribution to the annual fish-yield of the country. The problem is, however, the combination of tidal amplitude and sea level with the lay-out of the farms and, unfortunately, the tidal range is rather small in most of the open coasts of South India. Inexpensive pumping devices have to be worked out for such areas. In places where natural connections with the sea exist for these saline lagoons or where small streams open into the sea, it is observed that such areas have a rich fauna and flora both in numbers and species, contributing to the brackish-water or estuarine

biotope.<sup>1</sup> Similarly, in sheltered areas along the coast there is a rich marine fauna; very productive fisheries exist in the saline coastal lakes of Chilka and Pulicat. These factors would probably indicate that coastal fish ponds, if developed, would likewise develop a rich flora and fauna and also offer possibilities of enriching these waters by organic manures. The employment of chemical fertilizers will probably be beyond our means until their production in the country has made substantial progress.

The question naturally arises whether we could make better use of these areas than is now done without much expenditure for developing them into artificial marine fish farms. If the area is to be used for growing fish, we should require species which would grow to marketable size within 3 or 4 months, for that is all the really reliable period when water is available, and whose fry could be obtained on the coast in large numbers for stocking purposes. No such species at present seems to exist which would give reasonable harvest in so short a time, but there is need for much closer study on the subject. *Trichogaster pectoralis* (Regan) which grows to a length of 8 inches in 10 months' time<sup>8</sup> is probably suitable for areas where water is retained for longer periods, but it is known to be suitable only for waters of salinity less than 10 parts per mille. Similarly, it would appear that *Tilapia mossambica* Peters which was introduced into Malaya by the Japanese during the World War II might be another successful species. Both are not found in India and have to be introduced, but we are now not in a position to recommend the introduction of these species without ruling out the indigenous species, and without making sure that these species are not likely to affect the local ecological conditions and cause adverse effects. However, since both these species are non-predators, the danger to the autochthonous fauna is not great. The short duration available for growth, and the fact that both these species prefer waters of lower than higher salinities introduce serious handicaps in their selection for the utilization of marine coastal belts. The question of introduction of *Tilapia mossambica* deserves close study and it is necessary to formulate a national policy as to whether this species should be kept out of India, or its introduction actively encouraged. Being a hardy and euryhaline species with a comparatively high rate of reproduction, mouth breeding and with intermittent spawning seasons, it may be fairly

certain that, once introduced, the species would become permanently established as it has in many places in the Far East. Our indigenous species which might be affected are probably the fishes belonging to the same family Cichlidæ in India, viz., *Etroplus maculatus* (Bloch) and the Pearl Spot *Etroplus suratensis* (Bloch). The latter is a highly esteemed fish thriving in the back-waters and adjoining brackish tracts of the S.-W. Coast of India and in smaller numbers in some of the coastal districts of the E. Coast and steps have been taken by the State Fishery Department of Travancore-Cochin and Madras to popularize its culture. The fish is a nest builder and the rate of reproduction is discouraging for its selection as a species for large-scale culture. There has been a most marked depletion of the fisheries in the back-waters, canals and low-lying areas in Travancore during the past ten years, owing probably to the intensive fishing which has been going on without replenishment having taken place. Many areas which formerly used to yield appreciable numbers of *Etroplus* have ceased to be so. Although the probability exists that the fertility of the waters might have gone down in recent years, it is difficult to overlook that large amounts of organic food is still available in these waters especially after the first few rains. Under such circumstances the introduction of omnivorous feeders which can tolerate wide variations in salinity and which can reproduce more rapidly than *Etroplus* and establish as permanent species is an obvious suggestion. For raising a profitable crop of fish in the large numbers of small perennial ponds in the low-lying areas of the West Coast of India, there is also need for fish that would breed in the small volumes of water. *Tilapia mossambica* can successfully establish in closed waters and satisfies most of the requirements of salt-water fish culture.<sup>9,10</sup> However difficult it be for most zoologists to view the introduction of exotic species with equanimity, the question deserves close study.

It is well known that unchecked activity of predator species has in many areas been the cause of depletion of fisheries and no organized attempt has yet been made in many parts of India to remove and exterminate predators. It is also not realized that carnivorous species are best removed from small-scale fish ponds. On the other hand if they are cultured, the need for animal intermediaries in the food cycle of these species is not fully appreciated and provision is not made for the growth of species

which would serve as food for the carnivorous forms. The author has come across large numbers of perennial ponds in Travancore which support a rich plant life, but as regards fish fauna they contain nothing except occasional *Ophiocephalus* and many ponds of brackish water on the fringes of saline tracts, although rich in algæ, often contain little or no useful fish life. The need for hardy and quickly establishing crustacea valuable as food to other fishes is necessary in these waters. There is already one indigenous mysid which is found in the back-waters and estuaries of the East and West Coasts of India, viz., *Mesopodopsis* = *Macropsis orientalis* Tattersal which can be successfully spread by transplantation and can be cultured; it is a most hardy salt-water species capable of life in waters nearly fresh<sup>11</sup> and is consumed as food by most estuarine species.

Oyster culture is another line of utilization, but the people of this country have not yet taken a liking to this highly nutritive form of food, so that large-scale development of oyster farms cannot be recommended at this stage.

There is, however, a source of marine life which appears to be capable of more extensive utilization and offers scope for extended cultural practices. The prawns belonging to the family Penæidæ are extensively distributed in our seas and contribute to most valuable fisheries.<sup>12,13</sup> They are accepted as food by a majority of our people; they support a large volume of profitable export trade and fresh or frozen prawns are beginning to provide the basis of a luxury trade. The principal genera involved are *Penæus*, *Metapenæus* (= *Penæopsis*) and *Parapenæopsis*. The last-mentioned is mainly a marine genus, but species of *Penæus* and *Metapenæus* occur on the coast as well as in the back-waters. It is now known from the work of several investigators that these prawns which hatch out as nauplii unlike many other marine Decapods come near the shore when they are very young and ascend back-waters and estuaries when they are of sizes varying from 10-20 mm. In the habit of their breeding only in the sea and coming on shore when young, they resemble *Chanos chanos*. As is natural, the earliest phase in the development of farming operations is the trapping of fry found on the coasts and rearing them in convenient natural enclosures. The prawn cultural practices developed on the coast of Travancore-Cochin are based on the simple procedure of trapping the post-larval and young penæids in the paddy fields adjoining

coastal canals where they have entered from the sea by allowing tidal waters freely to enter the fields during high tides and to have closely meshed nets placed at the entrances to the field when the water flows out.<sup>13</sup> Selection of species is not possible by this method, but advantage is taken of the habits of the post-larval penæids whose appearance in large numbers coincides with the bunding operations of the rice fields soon after the North-East Monsoon, the fields being thus used for prawn culture during the season when not required for rice cultivation. In Bengal, Hora and Nair<sup>14</sup> have indicated how the salt-water Bheries of the Sunderbans area could be further developed so as to yield better supplies of fish and prawns than they do at present.

Young Penæids are found in all the coastal waters of India during most parts of the year—more especially, during the season October to January. On the East Coast of India large numbers of them are seen in the months immediately following the North-East Monsoon in October-November. Young ones of *Penæus indicus* M. Ed. and *Metapenæus monoceros* (Fabr.) have been found in most parts of the East and West Coasts and it appears from their distribution in the Indo-Pacific area that the species can be expected in most coastal areas, especially where there are tidal creeks or mud flats. On the East Coast a less abundant form is *P. carinatus* Dana which grows to a larger size than the other two in the coastal areas. Many other species like *M. dobsoni* on the Malabar Coast and *M. brevicornis* in Bengal are abundant and already form valuable fisheries. Most coastal areas of the E. Coast are admirable centres for the collection of prawn fry. Judged from the available data as well as from the observations of Schuster<sup>15</sup> in Indonesia, it is obvious that the young prawns grow extremely rapidly and attain marketable sizes within short periods. Schuster mentions that in the tambaks around the island of Java and Madura the prawns attain marketable sizes, *P. indicus* and *M. monoceros* growing to a length of 10-15 cm. within a period of 4-6 weeks. This amount of growth is probably too good to be taken as the general rule. From the observations made by Menon (unpublished) at Madras and Malabar, by Sadasivan (unpublished) at Upputeru at the mouth of the Collair (Kolleru) Lake and at Pulicat and from the author's observations made on different occasions at Cochin, Veli Lake near Tri-vandrum, Madras, Ennore, Akividu on the

Collair Lake and from collections seen from many other parts of India, the rate of growth of these species may be considered to be between 20-36 mm. within a month, the higher figures being applicable to prawns of very small size. High amounts of calcium are available in the saline lagoons which is beneficial to young prawns which frequently moult. As regards prawns of 40 mm. and above the rate of growth is probably less than above and with longer intermoult intervals as is usual in the Natantia. If the shallow coastal creeks and lagoons are stocked with prawns it is clear that they will be able to grow to utilizable sizes before these waters dry up, in the same manner as they do in areas where they enter during the spring tides. It appears, therefore, that further expansion of prawn cultural practices is definitely possible in India by collecting young post-larval penæid prawns from the coastal areas where they abound and by stocking them in coastal shallow lagoons and saline fish ponds into which the fry do not naturally enter. Elements of an unorganized fishery of this type already exist in some parts of the East Coast. Simple experimental observations which the author has made during the past few years indicate that prawn fry can be safely transported in earthenware containers and it should be quite possible also to utilize tin fish carriers.

There is, however, one great limitation in the extension of prawn cultural practices. Unlike *Chanos* the penæid prawns cannot be cultured in fresh water. They are, however, at home in waters of low salinities; *Metapenæus monoceros* is known to survive in waters of salinity as low as one to two parts per mille. *Penæus indicus* and other species on the other hand require considerably higher salinities, but low salinities are tolerated by the young ones of these species. What is noteworthy is that the penæids and, especially *Metapenæus monoceros*, show extraordinary powers of osmoregulation, achieved by the active regulation of chlorides in blood<sup>16</sup> indicating the same type of hypo-osmotic regulation as the palæmonid prawns<sup>17</sup> endowing them with an ability to thrive in salinity ranges not tolerated by most species and which, in fact, has considerably enhanced their value as culturable species.

Young penæids mostly remain buried in the mud with just their eyes and antennæ protruding and their food mainly consist of organic detritus found in the mud, algal material and other extremely small organisms contained in the mud. They are able to thrive in areas



devoid of much algal vegetation which is so necessary for *Chanos*. It may be added that the young prawns do not compete with *Chanos* for food and is hence widely employed subsidiary to *Chanos* culture in the Indonesian tambaks.<sup>15</sup> So far as the Indian Coast is concerned, what is required is an intensive collection and stocking of these penaeids in the coastal waters which are otherwise unused by the successful combination of the principles of the prawn culture of the Malabar Coast and the *Chanos* culture of the Eastern countries.

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S. India.

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## SYMPOSIUM ON CYBERNETICS

A CHARACTERISTIC of the evolution of science in the present century has been the progressive intermingling of the various branches formerly considered as independent. This is especially true of the post-war years which have witnessed the emergence of the fascinating branch of study called cybernetics from the unification of the methodologies of the mathematical, physical and biological sciences. A Symposium on this subject was held on 31st January and 1st February, 1952, at the Indian Institute of Science, Bangalore. It was inaugurated by Prof. M. S. Thacker, Director of the Institute, who also presided over the Session the first day; Dr. J. Chandy of the Christian Medical College, Vellore, took the chair on the second day. The purpose of the Symposium was mainly to stimulate interest in the field and to have a discussion in which workers in different sciences could take part. With this in view, reports on the various aspects of cybernetics were invited from workers in mathematics, physics, engineering, neurology and psychology both in Bangalore and outside. The Symposium, the first of its kind in India on this new branch of science, was organised by the Bangalore Branch of the Association of Scientific Workers of India and its success was mainly due to the efforts of Dr. B. S. Ramakrishna, President, and Mr. N. N. Narayana Rao, Secretary of the Association. It is recognised that the greatest progress is likely to occur in those regions of science which are the

meeting points of established subdivisions and symposia of this type should therefore act as a stimulus in furthering research in these borderlands.

In his inaugural address, M. S. Thacker pointed out that cybernetics, which considers the problems of control and communication in man and machine from a unified point of view, is a common field of investigation for scientists working in various fields. Thus, specialists in one field could place their intimate knowledge of their science at the service of other specialists and will in turn enrich their knowledge with what they can borrow from the others. On the practical side, cybernetics holds great promise to mankind, for instance, in the development of various devices which would help to replace one lost sense by another.

Opening the discussions, B. S. Madhava Rao dwelt on the scope of cybernetics and pointed out the fundamental role played by such diverse concepts as entropy in statistical mechanics and thermodynamics, feedback in engineering and even some aspects of mathematical logic in the terminology of cybernetics. The most important applications of cybernetics are in the field of neurology and rest on the hypothesis that the chief mechanism of the central nervous system is one of negative feed-back, which explains purposive and adaptive behaviour.

The next two papers dealt with information theory from the points of view of a communication engineer and a mathematician. B. S. Ramakrishna, who considered the former aspect,

discussed how the transmission of information can be studied quantitatively mainly as a result of the work of Wiener and Shannon. He indicated how the problem of communication through speech between one man and another can be discussed from this aspect and can thus become the object of study for acousticians, linguists, neurophysiologists and psychologists. V. R. Thiruvengkatachar's paper, which was presented by S. Dhawan, considered the time series nature of the messages transmitted in communication systems. It considered from the mathematical standpoint how best to recover a message which gets corrupted by noise during transmission and how to obtain an idea of the future of the message from the statistics of its past behaviour.

A set of three papers was concerned with the problem of feedback in men and machines and the manner in which they react to external stimuli. T. K. G. Menon and K. K. Nair dealt with the fundamental principles of feedback as met with in engineering, and pointed out how these could be applied to explain certain physiological phenomena. Such ideas may even be of possible use in explaining some aspects of social sciences. In the discussions which followed, Tischner indicated methods of determining the stability conditions of feedback systems. V. Narayana Rao spoke on the principles of mechanical servo-systems, their stability and their use in automatic tracking and remote control systems.

J. Chandy and B. Singh dealt with the cybernetic approach to the nervous system. The hypothesis that the mechanism here is analogous to the feed-back, scanning and servo-mechanisms met with in engineering is supported by the structure and function of neurones, Cajal's collateral and synapses. Proprioception, wakefulness and behaviour may thus be understood in terms of the above mechanisms occurring at various levels, i.e., spinal cord.

brain stem, cerebellum, basal ganglia and the cerebral cortex. Epilepsies may be due to derangement in the feed-back and scanning processes.

P. Srinivasa Rao explained how the general principles of instrumentation in machines are also applicable equally well to the sense organs of the living body. The main difference is that sense organs yield a combination of the instantaneous value and its time rate of change. He pointed out that in its reaction to external stimuli, the human physical motor behaviour is very similar to a servo-mechanism. The similarity between the functioning of the human brain and the working of machines like the modern automatic calculators was discussed by G. N. Ramachandran. He gave a description of the manner in which these machines work without any intermediate human aid and how they can perform many aspects of what may normally be termed "thinking".

M. V. Govindaswamy, taking the psychologist's point of view, said that although the cybernetical approach helps one in understanding some aspects of neurophysiology, the analogy between the nervous system and the communication system of the engineer is far from exact. He was of the opinion that although machines may be made to work in a manner similar to human beings, whether this approach can ever explain man completely is rather doubtful. The same opinion was expressed by J. Chandy. He pointed out that one must not conclude from the machine analogy that all neural and mental processes are essentially electrical in nature. In fact, the transmission of neural impulses at the synapses appear to be determined by the effects of chemical agents like enzymes.

Arrangements are being made to publish the full text of the papers presented at the Symposium.

## SULPHUR FROM SEA WATER

ALMOST sixty years ago, the interest in marine chemistry was great enough to render the idea of biological reduction of sulphates familiar to a few. Work over three decades on estuarial phenomena, Prof. Hugh Nicol claims,\* have shown that hydrogen sulphide can be re-

leased from the sea to any desired extent. The engineering difficulties in collecting the evolved gas may be considerable but there seems to be no relevant biological or chemical problem that cannot be tackled by present techniques, and the production of sulphur from sea water may prove to be no exception.

\* *Nature*, Nov. 24, 1951 p. 894.

THE GENETICAL BEHAVIOUR OF *SCLEROSTACHYA* × *NARENGA* HYBRIDS  
AND THEIR BACK-CROSSES

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*SCLEROSTACHYA* AND *NARENGA* have been found to play a part in the chromosomal constitution of *Saccharum officinarum*. Parthasarathy<sup>1</sup> found that the basic complement of  $n=10$  chromosomes of *officinarum*, is composed of 2 different chromosome complements  $n=5$  each and one of these is similar to 5 chromosomal complement of *Sclerostachya*. Raghavan<sup>2</sup> found that these five chromosomes bore homology to 5 chromosomes of *Narenga* also. The homology of the second set of 5 chromosomes has yet to be ascertained. Thus *Sclerostachya* and *Narenga* appear to be very closely related genetically. The hybrids between these two genera show complete allo-syndesis;<sup>3</sup> nor is there any reciprocal non-identity suggestive of cytoplasmic inheritance. A few characters were chosen for study in these hybrids and back-crosses with their parents. These reveal a few interesting features which are presented in this short paper. The presence of circlet of hairs at the nodes of the flowering culms (*Narenga* character) is dominant over its absence. The occurrence of pedicelled and sessile spikelets (*Narenga* character) is also dominant over its absence (*Sclerostachya*). The absence of hairs on the upper surface of the leaves (*Sclerostachya* character) is dominant over its presence (*Narenga* character). In the matter of the presence of nodal buds in the flowering culms (*Narenga* character), its absence (*Sclerostachya*) is dominant. Table I gives the number of plants examined in regard to these characters and the observations made. It will be seen

TABLE I

Characters	<i>Narenga</i>	<i>Sclerostachya</i>	<i>Narenga</i> × <i>Sclerostachya</i>	<i>Sclerostachya</i> × <i>Narenga</i>
Circlet of hairs ..	+	-	+142 - 5	+105 - 3
Hairs on upper surface of leaves	+	-	+24 -84	+ 37 -110
Spikelets: Pedicelled & Sessile (PS); Both Pedicelled (PP)	PS	PP	PS=47 PP= 1	PS=44 PP= 1
Nodal buds	+	-	- 9	- 9

that except in the character of hairs on the upper surface of leaves, the deviation from expectation is not significant in respect of the other characters. Also the selfed progenies show no appreciable segregation and as such it may be assumed that these are fairly homozygous for most of the characters.

When back-crossed to the respective parents, the following observations were made: In characters like the circlet of hairs, occurrence of pedicelled and sessile spikelets whose presence in *Narenga* is dominant, the back-crossed progeny with the parents would appear to show the

TABLE II

Parents		Circlet of hairs*	Spikelets †	Hairs on upper surface‡	Nodal buds§
Female	Male				
P' 567/3 ( <i>Narenga</i> × <i>Sclerostachya</i> )	<i>Narenga</i>	+26 - 1	PS=27 PP= 0	+27 - 0	+26 - 1
P' 567/3	<i>Sclerostachya</i>	+ 4 - 4	PS= 4 PP= 4	- 8 + 0	- 8 + 0
P' 567/3 (Self)	No survivals				
P' 568/1 ( <i>Sclerostachya</i> × <i>Narenga</i> )	<i>Narenga</i>	+ 8 - 0	PS= 8 PP= 0	+ 8 - 0	+ 8 - 0
P' 568/1	<i>Sclerostachya</i>	+ 2 - 2	PS= 2 PP= 2	- 4 + 0	- 4 + 0
P' 568/1 (Self)	No survivals				
<i>Ikra</i>	..	+24 - 0	PS=24 PP= 0	+ 2 -22	+ 2 -22
<i>Ikra</i>	<i>Narenga</i>	+14 - 0	PS=14 PP= 0	+12 - 2	+12 - 2
<i>Ikra</i>	<i>Sclerostachya</i>	+ 5 - 4	PS= 5 PP= 4	+ 2 - 7	- 8 + 1
<i>Ikra</i> (Self)		+13 - 5	PS=12 PP= 6	+ 7 -11	+13 - 5

\* + Present (*Narenga* dominant); - Absent (*Sclerostachya* recessive). † PS = Pedicelled & sessile (*Narenga* dominant); PP = Both pedicelled (*Sclerostachya* recessive). ‡ + Present (*Narenga* recessive); - Absent (*Sclerostachya* dominant). § + Present (*Narenga* recessive); - Absent (*Sclerostachya* dominant).

expected ratio, i.e., with the recessive parent, namely, *Sclerostachya*, we get the 1:1 roughly, while with the dominant parent, namely, *Narenga*, all the forms show the character in question. However, in characters like nodal buds in the flowering culms and hairs on the upper surface of leaf whose presence (*Narenga*) is recessive to their absence (*Sclerostachya*), the back-crossed progeny show this interesting feature. When back-crossed to dominant parent (*Sclerostachya*) all show absence of these characters which is as it should be. But when back-crossed to the recessive parent (*Narenga*), instead of the expected 1:1, all show the recessive character. It must, however, be admitted that the number of progeny available in these back-crosses is very limited and as such are not capable of statistical analysis. Even so it seems that in back-crosses with *Narenga* the deviation from expectation is highly significant only in respect of characters which are recessive in *Narenga*. Also it was noticed that survivals in these back-crosses are not very high and so far as selfed progeny of  $F_1$ 's are concerned, there has been practically no survivals. Hence it has not been possible to study the behaviour of these characters in the  $F_2$  population. Even so, it looks as if *Narenga* as the male parent exercises some influence in this matter, even though the character in question is recessive. It remains to be seen what the behaviour will be if *Narenga* and *Sclerostachya* are used as females and the  $F_1$  hybrids as male. It may also be mentioned that the pollen fertility of the  $F_1$ 's in either direction is

well over 90 per cent. Why there are no survivals in the selfed progeny of these  $F_1$ 's is not yet clear.

The expression of the characters mentioned above was studied in *Ikra* also. It was found that the genetical behaviour of *Ikra* is such as to confirm the belief that it is a natural hybrid between *Narenga* and *Sclerostachya*.<sup>3</sup> In other words, circlet of hairs was found to be present in the nodes of the flowering culm. Nodal buds were found to be absent in the nodes of the flowering culm. They were found to possess pedicelled and sessile spikelets, obviously the expression of dominance of *Narenga* character. In back-crosses with *Sclerostachya* and *Narenga*, the behaviour was also found to be the same, as if *Ikra* was the  $F_1$  hybrid between the two genera, and the interesting feature is that in back-crosses to *Narenga* in which the presence of some *Narenga* characters like nodal buds and hairs on upper surface, is recessive to their absence, all showed the recessive character instead of the expected 1:1. This uniform behaviour of these back-crosses involving *Narenga* as the male parent both in *Ikra* as well as artificial hybrids of *Sclerostachya* and *Narenga* is something which is worthy of note.

Table II gives in an analytical manner the expression of the characters in *Ikra* and in the back-crossed progeny available for observation

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2. Raghavan, T. S., *Journal of Heredity*, 1951, **42**, 599.
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## INTERNATIONAL COMPUTATION CENTRE

THE Convention for the setting up of an International Computation Centre was signed at Paris on 6th December, 1951, by Belgium, Egypt, Iraq, Israel, Italy, Japan, Mexico and Turkey.

The Centre is to be in Rome, where the Italian Government has offered a wing of its National Research Council Building. It also has agreed to lend the Centre \$ 75,000 without interest for

ten years. All the library and documentation facilities of the National Research Council will be at the disposal of the Centre.

The Centre's annual budget is expected to amount to about \$ 100,000, which will be made up from the contributions of its member states. For the first year, UNESCO will give the Centre a \$ 15,000 grant and a loan of \$ 60,000.

## LETTERS TO THE EDITOR

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ELECTRONIC TRANSITIONS IN THE  
COMPLEX BAND SPECTRUM OF  
NICKEL CHLORIDE

FOLLOWING the work on the band spectrum of nickel chloride reported previously,<sup>1</sup> it is found that the complexity in the structure of the bands arises from (1) an overlapping of different systems, and (2) the existence of high multiplicity electronic terms. The bands have been regrouped into five systems now designated as A, B, C, D and E of which C and D are the same as the systems 1 and 7 mentioned previously. The systems involve doublet and quartet terms.

The following Table gives the electronic transitions, the wave-numbers of the Q heads and the vibrational constants obtained in systems A, B and E.

System ..	A	B	E
Electronic Transition ..	${}^1\pi - {}^4\Sigma$	${}^4\pi - {}^4\Sigma$	${}^2\pi - {}^4\Sigma$
Q <sub>4</sub> ..	24305.7 cm. <sup>-1</sup>	23247.1 cm. <sup>-1</sup>	..
Q <sub>3</sub> ..	24185.6	23152.9	..
Q <sub>2</sub> ..	24064.1	23049.4	21688.2 cm. <sup>-1</sup>
Q <sub>1</sub> ..	23936.8	22946.7	21585.3
$\omega_e'$ ..	400.9	398.0	400.1
$\omega_e''$ ..	416.3	416.2	414.5

Systems A, B and E have a common lower state.

The (0, 0) sequence of system C presents double-headed bands of equal intensity. The system is assigned to a  ${}^2\Sigma - {}^2\Sigma$  electronic transition; the band heads are represented by:

$$\nu = 22749.2 + 398.9 u' - 1.03 u'^2 - 421.5 u'' + 0.51 u''^2$$

The vibrational formula for the band heads of the D system (also assigned as a  ${}^2\Sigma - {}^2\Sigma$  transition) is

$$\nu = 21920.5 + 404.4 u' - 1.16 u'^2 - 422.5 u'' + 0.25 u''^2$$

Of the observed different lower states  $^4\Sigma$  and  $^2\Sigma$ , it is not clear which is the ground state; probably both are low lying levels.

Full details will be published elsewhere.

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Waltair,  
December 31, 1951.

1. Krishnamurty, V. G., *Curr. Sci.* (In press).

#### PREPARATION OF 1-AMINO-4-HYDROXYANTHRAQUINONE

THE analytical reagent, 1-Amino-4-hydroxyanthraquinone is not available commercially and methods for its synthesis are covered by patents. Beilstein<sup>1</sup> mentions 7 methods. A successful synthesis was achieved by the following method:

*p*-Amino-phenol hydrochloride (6 g.) was placed in a dry round-bottomed flask (250 c.c.) and treated with concentrated sulphuric acid (sp. gr. 1.840; 15 c.c.) in small quantities until effervescence due to evolution of hydrogen chloride gas slowed up. The flask was heated on a water-bath until all the hydrogen chloride was driven out. Finely powdered phthalic anhydride (12 g.) was now added to the flask and thoroughly mixed. Boric acid (12 g.) was finely powdered and introduced. More sulphuric acid (15 c.c.) was added to make the mass pasty. A reflux air condenser closed with calcium chloride tube was attached to the flask and the latter was heated in an oil-bath gradually to 120° C. This temperature was maintained for 10 hours with occasional shaking. The end of the reaction was indicated by the entire mass becoming red. After cooling, the contents were poured into water (300 c.c.). The solid mass was filtered and washed with small quantities of water. The residue on the filter was boiled with water and filtered hot. The process was repeated three or four times with the residue to remove phthalic and boric acids completely. This was found to be the most tedious aspect. The final product was obtained as purplish red crystalline powder, m.p. 206° (Beilstein 207-208° C.). Yield 7.2 g. (Theoretical yield 10 g.). It was soluble in alcohol and benzene with a fuchsine red colour. Alkalis and acid solutions of concentration greater than 0.5 N

dissolved the compound. The colour in alcohol and acid was red and in alkali purple.

Waltair, N. APPALA RAJU.  
December 11, 1951. M. KANTHARAJ ARS.  
K. NEELAKANTAM.

1. Beilstein, *Handbuch der Organische Chemie*, 1933, 14, 268.

#### OCCURRENCE OF DETRITAL KYANITE, ANDALUSITE AND GARNET IN THE GULCHERU AND PULIVENDLA QUARTZITES

THE Gulcheru and Pulivendla quartzites are the basal members of the Papaghni and Cheyair Series respectively of the (Pre-cambrian) lower Cuddapah formations. Their outcrops are well seen to the west of the village Royalcheruvu in the Ananthapur District (Madras) and form a low range of hills trending in a general North-South direction.

During the course of an investigation of the heavy mineral constituents of the samples of these rocks obtained from near Royalcheruvu, the invariable occurrence of kyanite, andalusite, and garnet was repeatedly noticed by the author.

- (i) Kyanite occurs in colourless, small, straight, bent or twisted blades showing vertical cleavages traversed by horizontal partings. They are quite fresh and invariably show corroded borders. Some grains are cloudy due to alteration while a few have been completely reduced to micaceous aggregates. It forms about 1% of the total residue.
- (ii) Andalusite is not more than one or two grains per slide and generally smaller in size than kyanite. It is colourless to pale blue, and feebly pleochroic from colourless or pale blue to pale pink. It also shows corroded borders.
- (iii) Garnet is also not more than one or two grains per slide and is pale to deep pink in colour, quite fresh and shows corrosion structures like deep re-entrants and highly angular outline.

The other minerals present in the residue apart from these are iron ores, zircon, rutile, tourmaline and apatite.

The stability relations of kyanite, andalusite and garnet have been widely discussed by several writers like Smithson, Pettijohn, Bramlette, Dryden and Dryden, Hutton and others. Though these minerals may be able to withstand a certain degree of transportation over long dis-

tances and abrasion, they are considered to be highly vulnerable to post-depositional processes like the solvent action of interstratal solutions. The present trend of opinion is in favour of interstratal leaching as a more potent factor in controlling the nature and character of heavy mineral assemblages of sedimentary rocks than either the distance of transport or the resistance of minerals to abrasion during transport. Smithson<sup>1</sup> has observed corroded grains of garnet and kyanite in the Mesozoic rocks of Yorkshire and has considered their corrosion as due to the solvent action of interstratal solutions. Further, he has listed them as 'unstable' in the stability series established by him for the heavy minerals of the Mesozoic rocks of this area. Pettijohn<sup>2</sup> in his 'order of persistence' for 22 commonly occurring heavy minerals throughout the geological column arranged in the decreasing order of their persistence has placed garnet as No. 4, kyanite as No. 10 and andalusite as No. 13. He has also concluded that the simplified assemblages of most of the ancient sediments are mainly due to the removal of most of the vulnerable minerals originally present in them by interstratal leaching. Bramlette<sup>3</sup> has also offered a similar explanation for the total disappearance of garnets from ancient sediments. Dryden and Dryden<sup>4</sup> have shown garnet to be even less resistant to weathering than hornblende. Very recently Hutton<sup>5</sup> has expressed the opinion that garnet may be completely dissolved from water-lodged gravelly sediments mainly as a result of the action of interstratal solutions.

According to Pettijohn<sup>6</sup> kyanite is not known to occur in sediments older than lower palaeozoic and andalusite from rocks older than upper palaeozoic. Garnet, though found in rocks of all ages, appears to become poorer and poorer as the geological antiquity of the rocks increases. Hence the occurrence of these minerals now noted in the rocks of lower Cuddapah formations of older Pre-Cambrian age is specially interesting and may be of correlative value.

The presence of these minerals in the Gulcheru and Pulivendla quartzites of the lower Cuddapah formations in this part of the Cuddapah basin may also be due to certain special environmental conditions. Mackie<sup>7</sup> has shown calcium carbonate in a solid state as capable of preventing mineral grains from corrosion by interstratal solutions. Boswell<sup>8</sup> has argued that rocks of low porosity together with a superficial cover of clayey beds are protected to a greater extent from the drastic action of inter-

stratal solutions than the loose-textured and unprotected sediments. In the present case it is known that the Gulcheru quartzites are succeeded in the stratigraphical sequence by a fairly large thickness of Vaimpelle limestones, and the Pulivendla quartzites by the equally thick Tadpatri shales. Hence the persistence of detrital kyanite, andalusite and garnet in these quartzites may be due to the protective cover offered by Vaimpelle limestones and Tadpatri shales.

Further work on these rocks is under progress and the results will be published elsewhere.

The author is highly thankful to Prof. L. Rama Rao and Dr. P. R. J. Naidu for their valuable guidance.

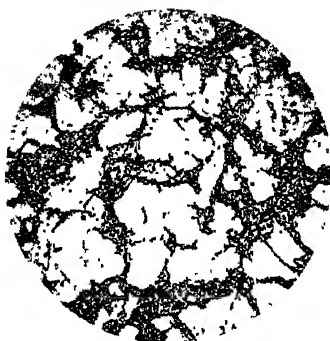
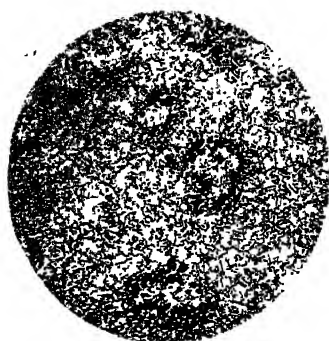
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January 22, 1952.

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#### FABRICATION OF ALUMINIUM BRONZE BY POWDER METALLURGY METHOD

WHILE studying the problem of fabricating alloys by powder metallurgy method, it was found that rapid homogeneity could be brought about if the rate of diffusion between partially soluble metals was accelerated by heating one of the metallic constituents above its melting point. This phenomenon has been adopted for fabricating alloys like tungsten carbide, etc., when cobalt is introduced as the binding material. A modified form of the same principle may be adopted in fabricating binary alloys, where the difference between the atomic radii of the constituents is not very large.

Alloys have been prepared by the above method with success. Below is described a method of fabricating aluminium bronze, i.e., alloys of copper and aluminium. Electrolytic copper powder freshly reduced in hydrogen at 300°C. was ball-milled with different proportions of chemically pure aluminium powder; the particle sizes being respectively — 200, + 300 and — 100, + 200 mesh. Mixtures were pressed in a nickel-chrome-molybdenum steel die



Photomicrographs of Aluminium alloys.

Sintering temperature: 900°C.

Sintering time; 32 hours.

1.0 % Aluminium  $\times$  170.10.0 % Aluminium  $\times$  170.12.0 % Aluminium  $\times$  170.

(length 3.0" width 0.33" and depth 1.5"), which was housed in a cast iron bolster, at a pressure of 25 tons per square inch. Sintering temperatures were selected from the thermal and dilatometric curves. It was found that sintering in pure hydrogen at 900°C. for 32 hours, a perfectly pure homogeneous alloy was obtained. The microstructure of the alloys thus obtained containing 1, 10 and 12% aluminium are illustrated here. The figures clearly show formation of a solid solution of aluminium in copper and the  $\alpha + \delta$  structures as expected from the equilibrium diagram. The very dark areas in the photomicrographs are voids which are invariably formed at such low compacting pressures. The mechanical properties of the alloys were determined using a Hounsfield Tensometer. Test pieces were made to size No. 13 having a cross-sectional area of .025 sq. in. and gauge length 0.632". The results obtained are as follows:

Aluminium %	Maximum stress (ton/sq in.)	Breaking stress (ton/sq.in.)	Elongation %	R.A. %
1	7.8	5.5	15	9
4	8.7	7.0	8	4
8	11.2	8.0	8	4
10	11.1	10.0	4	0
12	17.4	17.4	4	0

The above work was carried out at the Hadfield Research Laboratory, The University, Sheffield. Fuller details of the production of aluminium bronze by this method will be published elsewhere.

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#### THE SEEDS OF *WALKOMIELLA* *INDICA*—A CONIFER FROM THE LOWER GONDWANAS OF INDIA

WHEN we were studying coal from the Barakar stage by bulk maceration with concentrated nitric acid we obtained, besides microspores, a surprisingly large number of megaspores, small pieces of leaves and shoots, etc. From leaves



we were able to identify a new species of conifer, *Walkomiella indica*, a detailed description of which is in the press. From the same coal



we have obtained isolated seeds and some seeds attached terminally on short shoots. A close examination of the epidermal characters of the scale leaves of the seed-bearing short shoots showed that these seeds belong to the conifer, *Walkomiella indica*. The ovule or seed is bilaterally symmetrical, atropous and oval. It measures 2-2.5 mm.  $\times$  1-1.5 mm. Three layers, consisting of an integument, nucellus and a megaspore can be distinctly made out as shown here in the figure. The preservation is excellent and a detailed description will be published elsewhere.

*Glossopteris flora* is supposed to be relatively poor in species. Moreover, our knowledge of these plants is incomplete, which is partly due to the lack of suitable material. From our experience we find that the wealth and varieties of fossils which we can obtain from the maceration of large pieces of coal in bulk is, to say the least, surprising. Herein lies a new approach to the problem which will bring to light new facts about *Glossopteris flora*.

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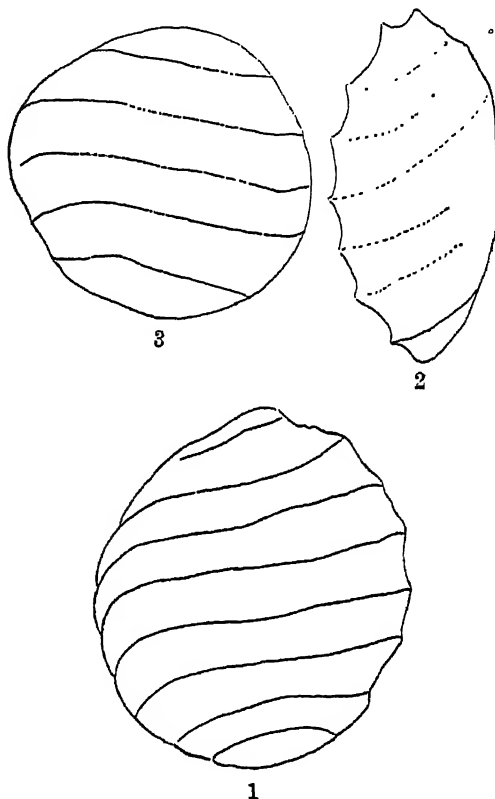
K. R. SURANGE.  
PREM SINGH.

# CHAROPHYTE REMAINS FROM THE JURASSIC OF RAJMAHAL HILLS, BEHAR

THIS note describes what is believed by the author to be the first record of Charophyta in the Gondwana rocks. Prof. S. R. Narayan Rao of the Lucknow University, who has been kind enough to examine the slides, has supported this observation and is of the opinion that the specimens belong indubitably to the Charophyta. Charophyte remains from different geological horizons in the northern hemisphere have so far been found mostly in the form of casts or silicified material of Gyrogonites and vegetative shoots. In India they are so far known only from the Deccan Intertrappean beds and consist chiefly of fruits (oogonia), in one case with the stem attached.<sup>4,5,6,7</sup> The specimens described here are oospores referable to *Nitellæ*. About a dozen specimens\* have so far been discovered in thin sections of chert collected by the late Prof. B. Sahni and party in 1948 from Nipania near Amrapara in the Rajmahal Hills.

**Description.**—No vegetative organs have yet been observed. The oospores are small in size,

ranging from about 130  $\mu$  to 150  $\mu$  long and about 80  $\mu$  to 145  $\mu$  broad. Most of them appear laterally compressed in the sections (Figs. 1-2), but others are spherical (Fig. 3). The oogonium is not preserved. This may be due to its walls not being calcified as is the case in modern *Nitella*.<sup>1,3</sup> All the specimens show distinct ridges which vary from 5-9 in number and ascend from right to left. The ridges show that the angle of convolutions is very low. The spirals are concave in some oospores (Fig. 2), and convex in others (Fig. 1), indicating respectively the



1. Oospore laterally compressed showing convex ridges ( $\times 200$ ).
2. Oospore obliquely placed showing concave ridges ( $\times 200$ ).
3. Oospore spherical in shape ( $\times 200$ ).

convexity or the concavity of the spiral cells in the oogonium.

The oospore wall in all the specimens possesses an ornamentation formed of polygonal meshes. The meshes are more or less of uniform size and tend to be arranged at places in tiers at right angle to the ridges. The number of meshes counted in vertical row from ridge to ridge varies from 5-9.

\* The material was kindly given to me for investigation by Dr. R. V. Sitcholey.

**Affinities.**—The distinctive characters of the present fossil oospores are the reticulate ornamentation of the wall, their small size, and laterally compressed form.



4



5

4. Spherical oospore showing reticulation ( $\times 260$ ).  
5. Laterally compressed oospore showing reticulation ( $\times 215$ ).

The author is not aware of any description of the ornamentation of fossil oospores of Charophyta. Most of the material is preserved in the form of casts which do not show the finer details of structure; therefore, comparisons have of necessity to be confined with the living types.

In size, our specimens are comparatively much smaller than the range of size met with in the oospores of the living Charophyta. Small oospores are, however, found in the Nitellæ and among these the smallest occur in the genus *Nitella*, measuring  $160\mu$  in length by  $175\mu$  in breadth.<sup>2</sup> The Rajmahal specimens approximate most closely to this size.

The form of the oospore has been looked upon as a character of no less importance in distinguishing Nitellæ from Charæ. The laterally compressed form is known to occur only in the Nitellæ, though terete oospores are also found in this group. In the Charæ only the terete form occurs. The fossil oospores thus compare with those of the Nitellæ.

The sum total of the characters, i.e., (1) their small size, (2) the laterally compressed form, and (3) the reticulate ornamentation of the oospore wall indicates for the Rajmahal fossils

a greater affinity with the Nitellæ than with the Charæ.

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#### MANGANESE MICAS FROM A PEGMATITE IN INDIA

THE schists and the pegmatite of the Sitasaongi manganese mining area\* are very rich in mica. The schists contain muscovite and biotite, while the micas found in the pegmatite show some unusual characteristics. Two varieties have been distinguished in the micas from the pegmatite, based on the differences in the megascopic and microscopic character, viz., (1) alurgite, (2) manganophyllite.

(1) *Alurgite*.—Two specimens (V/291 and V/288), collected from the pegmatite at 140' and 60' levels of the Sitasaongi Mine very closely conform to the description given by Dana (1892, p. 635). The mineral is dark-red in colour and the fine splittings when held before light look deep brownish red in colour. Hexagonal plates of the mineral are also met with. The mineral when heated to a high temperature turns white but regains its colour on being moistened.

In thin sections, the mineral is brown or reddish-brown in colour and shows a marked pleochroism. The pleochroic scheme is:

X = pale brownish yellow,

Y = reddish brown and brownish yellow.

The mineral is uniaxial to biaxial negative. When biaxial, 2E does not exceed  $4^\circ$ . Fermor (1909, p. 198), has included all pink micas under the name alurgite even though their optic axial angles reach as high a value as  $59^\circ$ – $65^\circ$ .

The mineral when mixed with the usual fluxes gives a definite test for manganese.

(2) *Manganophyllite*.—In the pegmatite at 140' and 60' levels of the Sitasaongi Mine, some deep brownish-red mica plates and lumps were collected. In hand specimens, this mica has a

\* Chikla area under study—Bhandara District. Lat.  $21^\circ 31'$  and  $21^\circ 35'$  N, and Long.  $79^\circ 41'$  and  $78^\circ 49'$  30' E.

different look from the mica described above. In thin section, the mineral is reddish-brown in colour and shows a marked pleochroism, the pleochroic scheme is:

X = straw yellow,

Y = deep orange brown.

The mineral is biaxial negative with 2E varying between 30°-35°.

Manganophyllite differs from alurgite in its physical as well as optical properties. The optic axial angle is 0°-4° for alurgite and 30°-35° for manganophyllite.

The mineral, like alurgite gives definite tests for manganese. The identifications are provisional because chemical analysis and detailed optical work could not be undertaken.

It is suggested that these micas are the original constituents of the pegmatite. It may be assumed that a part of iron and alumina has been replaced by manganese, and that this small amount of manganese is responsible for the properties like pleochroism, etc., exhibited by them.

Grateful thanks are due to the C.P. Mangane Ore Co. Ltd. (Nagpur), for providing facilities for this work and to Prof. N. L. Sharma and Dr. M. S. Sadashivaiah for their helpful guidance.

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#### PHAGOCYTIC COEFFICIENTS OF CERTAIN INDIGENOUS MEDICINAL PLANT EXTRACTS

It was noticed in a preliminary survey that some of the medicinal plants of reputed therapeutic action had little antibacterial effect on the test bacteria *Escherichia coli* and *Staphylococcus aureus* (unpublished work). Hence it was considered worthwhile to study the action, if any, these plants might have on the phagocytic function of human blood leucocytes *in vitro*. The results are presented in this paper.

Leaves of *Murraya koenigii* Spreng. and nuts of *Areca catechu* Linn. were selected for a study in contrast since the former which are singled out for setting right "blood disorders"<sup>1</sup> presumably by aiding the phagocytic function and other disease-resisting factors in live tissues) could be examined with the latter, which is a popular chewing item, usually believed to be associated with a lowering of body-resistance and a consequential increase in susceptibility to diseases like tuberculosis known to

be connected with a low phagocytic index. For experimental work the reaction mixture consisting of 0.1 ml each of normal saline, the extract or its dilution in saline, citrated human blood<sup>2</sup> (final citrate concentration in blood being 0.02 M) and a uniform suspension of *Micrococcus citreus* (more amenable than other pathogenic Micrococci for reason of the absence of plasma coagulase) was incubated for 30 minutes in a 37° C. water-bath, whereafter the leucocytic 'cream' was separated from each mixture, spread, stained by Leishman's stain and a count of the engulfed bacteria made on 50 neutrophilic polymorphonuclear leucocytes. The phagocytic coefficient as defined by Davies<sup>3</sup> was calculated. The results are presented in Tables I and II.

TABLE I

Extract	Plant	Plant-part	Quantity in g	Solvent	ml solvent	How extracted
1	<i>M. koenigii</i>	leaves	2	water	20	cold, overnight
2	"	rachis	2	"	20	"
3	<i>A. catechu</i>	nut	10	"	100	"
4	"	"	10	saline	100	"

TABLE II

Extract	Phagocytic coefficient at dilution						
	1:0	1:2	1:5	1:10	1:15	1:20	0:1
1	— <sup>a</sup>	— <sup>b</sup>	1.71	2.21	2.07	2.07	1.00
2	1.50 <sup>c</sup>	1.07	1.28	1.28	1.35	1.21	1.00
3	0.40 <sup>d</sup>	0.80 <sup>d</sup>	1.29	1.00	0.95	1.10	1.00
4	0.30 <sup>d</sup>	0.85 <sup>d</sup>	0.95	1.15	0.95	0.90	1.00

a, Clot after incubation; b, Clot after centrifugation; c, Red blood corpuscles were lysed; leucocytes had ill-defined cell walls; d, The supernatant in these tubes was fairly turbid, the turbidity decreasing with increasing dilution; most leucocytes were completely distorted, the protoplasm of the neutrophilic leucocytes having acquired the basophilic stain.

The values for the phagocytic coefficients of the leaf extract of *M. koenigii* indicate its favourable influence on the normal phagocytic function and amply justifies its use *in vivo* for blood disorders; the extract of its rachis has a lesser activity.

The findings for *A. catechu* substantiate the belief regarding the *in vivo* effect of the nut, as it has a depressing effect on the normal phagocytic function. In another series of experiments, details of which will be published else-

where, the phagocytic coefficients of both extracts were determined using blood from another individual with a view to check the values presented above, for these are known to vary with every individual. It was again noticed that the phagocytic coefficients were considerably low in the presence of undiluted extracts and when diluted out 1:2, and at greater dilutions, the values tended to reach the normal figures. Trauma to leucocytes due to the presence of the extracts was evidenced in all tubes, the neutrophilic cytoplasm of the leucocytes acquiring basophilic characteristics. The change in the morphology and staining reaction of the leucocytes in the presence of these extracts indicates the nature of the damage they are believed and are likely to bring about *in vivo*. Furthermore, a count made on the number of reacted leucocytes indicated that approximately 68, 86 and 98 per cent. had functioned in the phagocytic process at dilutions 1:0, 1:2 and 1:5 respectively. At higher dilutions, the percentage of reacting leucocytes approached normalcy, i.e., 100 per cent.

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#### QUANTITATIVE DETERMINATION OF AMINO ACIDS SEPARATED BY CIRCULAR PAPER CHROMATOGRAPHY

VARIOUS procedures have been suggested for the quantitative determination of amino acids on filter-paper chromatograms. These may be classified into the following groups:

(1) Comparison of the colour intensity of standard and test sample chromatograms following treatment with ninhydrin, visually<sup>1,2</sup> or by photometry;<sup>3-6</sup> (2) Direct comparison of the size of ninhydrin stained spots of standard and test samples<sup>3,7</sup> or by making photostatic prints from the negative of the chromatogram and measuring the spot areas with a planimeter;<sup>8</sup> (3) Elution of the spots before or after staining with the ninhydrin reagent and estimation of the amino acids in the eluates;<sup>2,9-14,16</sup> (4) Estimation of amino acids without elution<sup>13,15</sup> the reagent being added directly to

pieces of paper containing the amino acid cut from the chromatogram.

Most of the methods require considerable manipulative skill and are also rather tedious to carry out.

We have attempted to develop a simple quantitative method based on the extraction of the colour of the ninhydrin stained zones with 75% alcohol<sup>16</sup> and comparison of the colour intensity with a known sample of amino acid similarly treated or estimation from a calibration curve drawn for each of the amino acids. By this method 3-5  $\mu$ g quantities of amino acids separated on the chromatogram can be accurately determined.

The method briefly consists of the following steps: (1) Staining the amino acid zones after running the chromatogram as described before<sup>17</sup> with 0.5% ninhydrin reagent in acetone and drying it at 65° for about 15 minutes. (2) Cutting the zones stained with ninhydrin and introducing the papers rolled, into a test tube containing 4 c.c. of 75% alcohol and shaking for about 5 minutes until the colour is completely extracted. It was found that although acetone extracted the colour completely, the intensity of the colour obtained by extraction with 75% alcohol was nearly twice that obtained by acetone extraction. The colour was found to be stable for nearly 2-3 hours at room temperature. The ninhydrin colour of the alcoholic solution can be extracted by isoamyl alcohol and *n*-butanol. But the colour was not stable in these solvents. (3) Measuring the intensity of colour of the alcoholic extract using Klett-Summerson photoelectric colorimeter using 540 *mμ* filter and a test tube 1 cm. in diameter. (4) The quantity of the amino acid can then be estimated from the calibration curve drawn for each of the amino acids. It is, however, desirable to verify the value obtained by calculation from the calibration curve by running the mixture of known amino acids of known concentration on the same paper and comparing the colour intensities of the solutions with those obtained by running the mixture of unknown amino acids.

Using this method, circular paper chromatogram of threonine and isoleucine mixture run with *n*-butanol-acetic acid-water as the solvent gave recoveries of 98-100% for threonine and isoleucine.

Typical calibration curves obtained with cystine, tyrosine, iso-leucine, valine and glycine in the range of 3.2-12.8  $\mu$ g showed direct proportionality between optical density and con-

centration. This method when applied to the estimation of phenylalanine and tyrosine in casein hydrolysate after separation of the amino acids by circular paper chromatography<sup>17</sup> gave values of 5.05 and 6.3 respectively. The values were calculated on the basis of 16 g. of nitrogen per 100 g. of casein.

The simplicity of the technique combined with its sensitivity and accuracy makes it an excellent method for the amino acid analysis of proteins in plants and animal tissues, blood and urine.

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#### A DIRECT VOLUMETRIC PROCEDURE FOR ESTIMATION OF THORIUM\*

VOLUMETRIC methods so far reported for the estimation of thorium<sup>1-8</sup> have been considered to be "either involved, highly indirect, or inaccurate".<sup>9</sup> A simple, direct and accurate titrimetric procedure for estimation of thorium is presented in this note.

The method consists in titrating a known volume of standard oxalic acid solution against thorium nitrate, using alizarin S as internal indicator. Thorium oxalate is precipitated in

the course of titration; the end point is indicated by a sharp change in colour from yellow to red owing to formation of red thorium-alizarin lake. This procedure has been successfully used with 0.1 N solutions. When 0.01 N solutions are employed, however, the end point is found to be sharp only when the titration is completed at about 90° C.

Close agreement has been observed between results obtained by the gravimetric procedure (in which thorium is precipitated as oxalate, ignited and weighed as oxide) and the volumetric procedure described herein.

In place of oxalic acid, oxalates can also be employed, provided the requisite amount of acid is also added. Other dibasic acids and organic acids so far proposed for gravimetric estimation of thorium have been tried in place of oxalic acid. Details will be published elsewhere.

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#### MUTUAL SUPPLEMENTATION IN VEGETABLE PROTEINS

PEANUT CAKE has received attention as a source of valuable protein supplement in human nutrition.<sup>1</sup> Cottonseed cake has also been suitably processed into a flour which could be used on a large scale in the biscuit industry.<sup>2</sup> Cocomanut cake and flour have been successfully used in combination with wheat flour for producing a fairly nutritive bread.<sup>3</sup>

Although oilcakes are valuable sources of proteins and are abundantly available, they require systematic processing so as to eliminate the toxic principles<sup>4</sup> and proteolytic inhibitors<sup>5</sup> present in some of them. The more common drawbacks that are mainly responsible in preventing oilcakes from being incorporated in food preparations are, (a) the unhygienic conditions under which these cakes are obtained, (b) the presence of stone and gritty matter,

\* These studies were supported by a grant from the Indian Council of Medical Research.

(c) the bad flavour owing to unhealthy seeds being used during crushing, and (d) the development of rancidity as a result of the residual oil in the cake. If these defects could be eliminated, the product would find ready application as a source of supplementary food. Even so, oilcakes are low in biological value (varying between 50 and 60) due chiefly to deficiencies in essential amino acids, particularly lysine and methionine. It would seem, however, that when presented in suitable mixtures, they have fairly high biological value and our results on this problem are briefly discussed in this communication.

The biological value determinations were carried out by the nitrogen balance method of Chick, *et al.*<sup>6</sup> Peanut, cottonseed, sesame, soya, copra, wheat and yeast were used as protein sources. These were mixed in certain suitable combinations and in proportions as indicated in the Table. The protein level was 10% in all cases.

TABLE  
Protein Value of Mixtures of Oilcake Proteins

No.	Mixture	Composition	Protein content	Biological value	Digestibility coefficient	Net protein value
1	Peanut	55				
	Wheat	25	47.15	70	91.3	30.13
	Cottonseed	20				
2	Peanut	60				
	Sesame	20	53.4	50	93.0	27.81
	Cottonseed	20				
3	Peanut	60				
	Yeast	10	57.41	60	86.9	29.92
	Cottonseed	30				
4	Peanut	65				
	Wheat	25	47.55	51	84.3	20.45
	Yeast	10				
5	Peanut	60				
	Soya	20	52.8	72.5	87.2	33.38
	Sesame	20				
6	Peanut	60				
	Cottonseed	20	52.4	60.8	87.3	27.81
	Copra	20				
7	Peanut	65				
	Yeast	10	50	55.5	88.9	24.0
	Copra	25				

The results show that while some mixtures of cake proteins like (a) peanut, wheat and cotton seed, and (b) peanut, soya and sesame, have given significant increases in biological value, others have shown little or practically no increase. A study of the data of the essential amino acid make up of these mixtures as

reported in literature, did not help to explain satisfactorily the low biological value obtained in these cases. For a proper interpretation of these results, it is necessary to take into account the rate and timely release of the amino acids which are important factors for effective supplementation.<sup>7</sup> This is now being studied.

It would also appear from the results that oilseed (peanut) globulins are supplemented adequately either by cereal proteins like those of wheat or by the proteins from a legume like soya. A mixture consisting of only oilseed proteins, does not supplement peanut proteins.

It is also observed that wherever yeast formed one of the constituents of the mixture, the biological value is invariably lowered. This is perhaps, due to toxic factors, like amino pyridine, known to be associated with yeast.

Our thanks are due to Dr. S. S. De for his keen interest in the progress of this work.

Food Technology Lab., B. M. LAL.  
Ind. Inst. of Science, R. RAJAGOPALAN.  
Bangalore,  
December 21, 1951.

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#### ALKALOIDAL CONSTITUENTS OF *WITHANIA SOMNIFERA*

IN continuation of the earlier work by Majumdar and Guha,<sup>1</sup> it has now been possible to isolate six alkaloids from the acetone soluble part of the total alkaloidal precipitate with Dragendorff's reagent. It has been further confirmed that one of these alkaloids is definitely nicotine. The remaining five alkaloids have been named as *somniferine*, m.p. 185-87°; *somniferinine*, m.p. 120° after primary decomposition between 95-100°; both are alcohol soluble but chloroform insoluble; *withanine*; m.p. 87-88°, chloroform soluble but ether and benzene insoluble; *withananine*, m.p. 35-40° ether and benzene soluble; *withananinine*, m.p. 90-95°, benzene soluble but ether insoluble. They are all coloured brown. Further work is in progress.

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Banaras Hindu University,  
October 22, 1951.

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BIOLOGICAL STANDARDISATION OF  
DIGITALIS USING DOGS

RICHARD<sup>1</sup> in a general survey of assay methods for the cardiotonic group of drugs found that the dog generally reacted to intravenous administration, but the response could in no way be correlated either with the weight of the animal or to the dosage of the drug given. He therefore opined that dogs were unsuitable for the assay of this group of drugs, Haskell, *et al.*<sup>2</sup> and Tiffeneau, Levy and Pichot<sup>3</sup> using dogs for the bioassay of digitalis came to the conclusion that a fairly satisfactory assay may be carried by using from 6 to 10 dogs for each test, the average value for the dog being 1.75 times the M.L.D. for cats. McGuigan and McGuigan<sup>4</sup> used dogs anaesthetised with phenobarbital (35 mg per kilo body weight in 5% alc. solution given intraperitoneally) and tincture digitalis was injected to femoral vein in a dose of 0.1 c.c. per kilo of body weight every 5 minutes and continued for 1 hour. Artificial respiration was not given in every case. They concluded that in the case of the dog, the results were within 20% of the actual strength of the drug.

In our work we used dogs weighing from 1.9 to 5 kg. of body weight. They were anaesthetised by seconal sodium (30 mg. per kg. of body weight given i.p.). Blood pressure and respiration were recorded in some cases. Artificial respiration was not resorted to. Tincture digitalis was perfused through the femoral vein at the rate of 2-3 c.c. of diluted tincture (1:20) so that the rapid fall of blood pressure occurred after 30 minutes and not later than 1 hour in each case. The data obtained for the standard,<sup>5</sup> and samples of tincture sent for analysis to our laboratory are given below:

TABLE I

Bioassay of Tincture Digitalis (Dilution 1:20)

Expt. No.	Standard		Sample	
	Wt. of dog in kg	Dose given per kg in c.c.	Wt. of dog in kg	Dose given per kg in c.c.
1	5.4	30	4.5	20.2
2	4.5	42.3	4.05	29.0
3	4.4	26.7	3.71	45.4
4	4.1	23.5	3.26	29.04
5	3.6	22.8	2.5	34.0
6	2.1	22.8	1.9	27
Average per kg body weight of dog		28.01	32.2	

It is evident that the error is within 10% of the value, 29.75 c.c. obtained by McGuigan, *et al.*,<sup>4</sup> for the international standard. The individual variation when many dogs are used is not more than with cats. David, *et al.*,<sup>6</sup> also got the same result using the 1926 international standard.<sup>5</sup> Therefore, it may be safely concluded that the dog can replace the cat without any sacrifice of accuracy of results. Also dogs are more easily available in our country than cats and more convenient to handle too. Hence, for the bioassay of tincture digitalis by the dog method 28.0 c.c. per kg of body weight can be taken as the standard dose.

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A. S. RAMASWAMY.  
N. N. DE.

\* The standard digitalis leaf powder (1936 standard) was supplied by the kind courtesy of the Director, Biochemical Standardisation Laboratory, Calcutta.

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## RING DISEASE OF POTATO IN INDIA

*Phytophthora solanacearum* (Sm.), Patel and Kulkarni, the causal agent of the ring disease of potato was first recorded in India in 1892. Considerable work has been done on it in Mysore and Bombay by Coleman<sup>2</sup> and Mann and Nagpurkar.<sup>3</sup> The disease is now found in almost all the potato-growing areas of the world. In Bombay State, it used to be a limiting factor in the cultivation of potato as the cultivators used the same stock for 6-10 seasons (3-5 years). It has, however, now ceased to be of importance since seed potatoes are imported annually from the snow-fed, disease-free hills of Simla (altitude, 7,000 ft.).

A similar disease, producing identical symptoms caused by *Aplanobacter sepedonicum* (Spiek. and Kott.) Sm., was reported from Germany in 1913 from where it has made its way to Canada and U.S.A. Many Indian investigators feel doubtful about the identity of the

Characters	Indian potato ring pathogen	<i>Phytobacterium solanacearum</i>	<i>Aphanobacter sepedonicum</i>
Motility	Motile	Motile	Non-motile
Gram's stain	.. Negative	Negative	Positive
Nutrient broth	.. Poor growth, cloudy colour turning brownish, no pellicle	Appreciable turbidity and distinct pellicle.	Poor growth. Shade of yellow colour, no pellicle.
Nutrient agar slants	.. Growth poor to fair, flat, dull, whitish, putrefactive smell.	Growth poor, dirty white to brown.	Growth poor, shade of yellow colour.
Nutrient dextrose agar slants	.. Abundant growth, medium turning acidic.	Dirty white, turning brown.	White and good growth.
Potato dextrose agar slants	.. Good growth, dirty white, smooth, glistening, flowing	Abundant growth and intense production of pigments.	Abundant growth and intense production of pigments.
Potato cylinders	.. Good, slimy, flowing, dull, smooth growth, turning dirty white to brown.	Colour changed to brown.	..
Temperature relations—			
Minimum	.. 10° C.	10° C.	4° C.
Optimum	.. 25° C.	35–37° C.	20–30° C.
Maximum	.. 35° C.	41° C.	31° C.
Liquefaction of gelatin	.. Nil	Slight	Slight
Hydrolysis of starch	.. Nil	Nil	do
Production of H <sub>2</sub> S	.. Nil	Nil	do
Indole production	.. Nil	Nil	Nil
Citrus milk	.. Alkaline	Alkaline	Slight reduction
Litrates	.. Reduced	Reduced	Not reduced
Carbon utilisation—			
Lactose	.. Alkaline	Alkaline	Acid
Maltose	.. do	do	No change
Inulin	.. do	do	Neutral
Xylose	.. Neutral	do	Acid
Dulcitol	.. do	do	Alkaline

ring disease organism in India and as some have even stated it to be due to *A. sepedonicum*, the writers collected diseased potato tubers of the variety Great Scott from the Nilgiris, Numbri (up-to-date) grown locally, Darjeeling red from Darjeeling, Phulwa from Patna (Bihar), Italian White grown locally and at Farukabad (U.P.), from which the pathogen was isolated and studied in detail. The results of our investigation of ring and brown rot disease are given above.

Chilli and tobacco are not affected. The organism causes a wilt in tomato, potato and egg plants. Typical symptoms manifest after 3–5 days, but actual wilting is seen after 7 days. Virulence is lost in culture within 3 months; however, the organism can be best maintained in milk. Periodical plantings indicate that it remains viable for about 8 months in sterilised soil.

The symptoms of the disease and the morphological, cultural and biochemical characters of the ring pathogen isolated from potato tubers

grown at several places show conclusively that the organism is identical with *Phytobacterium solanacearum* (Sm.) Patel and Kulkarni.

Plant Pathological Lab., M. K. PATEL.  
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Poona 5, Y. S. KULKARNI.  
November 8, 1951.

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### VERNALIZATION OF PEAS

A NUMBER of leguminous crops have been vernalised during the last decade.<sup>1,2,3,4</sup> However, no work appears to have been reported on the effect of vernalisation on formation of root nodules and their nitrogen fixing capacity in leguminous crops. The present study was therefore taken up, to record response of pea variety N.P. 29, to vernalization.



The seeds were vernalized at 45° F. for four weeks (A), Six weeks (B), Eight weeks (C) and no vernalization (D). After treatment, they were sown in microplots in the field. They were given normal intercultural and irrigations. No manures were added. Flowering, root nodule formation and grain yield were recorded, which are given in the Table I.

TABLE I

Showing Flowering, Number of Root Nodules and Grain Yield of Vernalized Pea Seeds

Treatments	Flowering in days	Number of root nodules per plant	Grain yield in g.
A	67	35.5	998.8
B	72	22.0	1013.2
C	69	20.2	965.6
D	69	8.5	598.4

Peculiarly enough, no marked earliness was observed in the treated plants. Maximum earliness of 2 days and lateness of 3 days were obtained as given in Table I. The treated plants tended to remain green, for a longer time, in field. The results are in conformity with Tulai-kova's<sup>5</sup> findings who reported an earliness of 6-9 days in peas due to vernalization.

The number of root nodules formed, after 78 days was counted, and the results (average of 4 plants) are given in Table I. A marked increase in the number of root nodules per plant was observed due to vernalization. It was highest in the seeds which were treated for 4 weeks.

The grain yield of 68 plants was recorded separately for each treatment by weighing the grain and the results are shown in Table I. The increase in yield may be attributed to vernalization which accelerates the physiological processes as suggested by Maximov.<sup>6</sup> Further studies are in progress.

The author wishes to express his thanks to Dr. L. B. Singh, for his valuable comments and guidance.

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### OCCURRENCE OF PERSISTENT POLLEN TUBES IN MALVACEAE

IN the majority of Angiosperms, the pollen tubes after reaching the embryo-sac, discharge their contents, collapse and become unrecognisable a little later. But in some cases they are reported to persist till a late stage in the development of the embryo (see Maheswari, 1950, for literature; also Maheswari and Johri, 1950). In a few of these cases the pollen tubes remain intact and serve a haustorial function as those of Malvaceae described below.

In other families of Malvales, namely, Sterculiaceae, Tiliaceae and Elaeocarpaceae studied by the writer, the pollen tubes were ephemeral as in the majority of Angiosperms. But in *Pavonia zeylanica* L., *Sida veronicæfolia* L. (= *S. humilis* Willd.), *Malachra capitata* L., *Hibiscus micranthus* L., *H. hirtus* L., and *H. solandra* L. Herit. belonging to Malvaceae, whose embryology was studied by the writer, the pollen tubes were found to persist in tact till a late stage in the development of the embryo (Fig. 1).

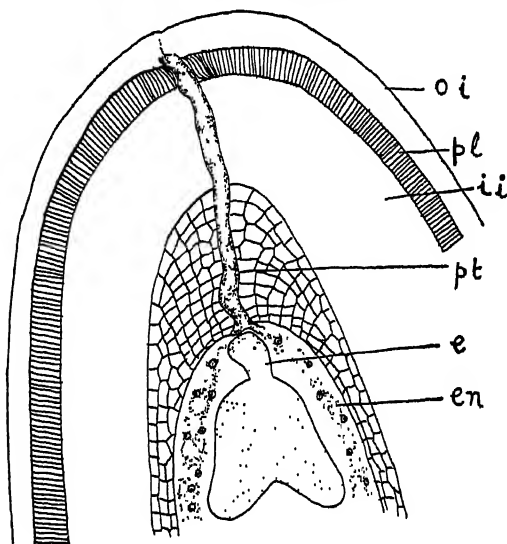


FIG. 1. L. S. seed of *Hibiscus solandra* showing persistent pollen tube,  $\times 80$ .

The pollen tubes measure 15-20  $\mu$  in diameter. After reaching the tip of the nucellus, they give off a few branches one of which may reach the inner integument, while the main tube progresses towards the egg. Even after discharge of the gametic nuclei, the tube does not collapse or show signs of degeneration. It is provided

with a tough membrane which is lined on the inside by a thin layer of cytoplasm. Its open ends stand very near to the base of the developing embryo. In all the species investigated, the embryo develops rapidly reaching maturity in 5-6 days. So it is probable that the pollen tube functions in the rapid transport of food materials from the parenchymatous cells of the inner integument several layers of which get crushed during the development of the seed.

The writer wishes to express his thanks to Prof. A. C. Joshi and Prof. J. Venkateswarlu for their kind interest in the work.

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Andhra University,  
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November 28, 1951.

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#### RAW-RICE WASHINGS—A SOURCE FOR CANE GROWTH FACTORS

BONNER, HAAGEN-SMIT AND WENT<sup>1</sup> have shown that seed diffusates and extracts of young leaves contain many of the important growth principles which promote the growth of plants or plant parts. Van Overbeek, Conklin and Blakelee<sup>2</sup> have demonstrated that coconut milk provides accessory substances which stimulate the growth of isolated very young *Datura* embryos. The present note deals with the use of raw-rice washings for promoting the growth of plants.

According to a recent report in the daily press, a Sorghum (Jowar) plant in East Godavari District grew to a height of about 16 feet with a stem circumference of about 4 inches and produced an earhead of about 15 inches when raw-rice washings were added daily to the plant.

Experiments were made with seven poor vigour varieties of sugarcane, viz., *Vellai*, *Gillman*, *Red cane*, *Karun*, *Mauritius 33*, *Ashy Mauritius* and *Toungoo Yellow*, which have been grown for three months, from the time of germination, in sand cultures, with additions of (i) Buffered Knop's<sup>3</sup> solution containing all micronutrients once in a fortnight, and (ii) raw-rice washings, daily. Raw-rice washings have a definite growth-improving action on sugarcane and is characteristically seen in the main shoot heights of the plants given in Table I.

#### Height in inches of Main Shoots of Different Canes

(After 3 months' growth in sand cultures)

Treatment \ Variety	Vellai	Gillman	Mauritius 33	Red cane	Karun	Ashy Mauritius	Toungoo Yellow
(i) Buffered Knop's solution containing all micro-nutrients	37.6	29.3	12.9	37.0	15.8	11.6	10.7
(ii) Rice washings	51.0	45.7	50.3	36.9	40.8	42.3	51.7

(Borer)

The nature of the physiologically active substances present in rice washings which give them their stimulating property is under investigation, and the results will be published elsewhere.

Grateful thanks are due to Shri N. L. Dutt, Director, for his keen interest in the work and for many helpful suggestions.

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#### ARSENOPHOSPHOTUNGSTIC ACID— A MICROREAGENT FOR CERIUM

KOMAROVSKY AND KORENMANN<sup>1</sup> reported the use of phosphomolybdic acid for the detection of microquantities of cerium. The author tried phosphotungstic acid for the same purpose, but without success. The observations were next extended to arsenophosphotungstic acid—Benedict's reagent,<sup>2</sup> which produced a characteristic blue colour when a drop of it was treated with a drop of any cerous salt solution and of 30 to 40% sodium hydroxide successively on a spot test tile or paper. Under comparative conditions the intensity of the colour was found to be the same as that obtained with phosphomolybdic acid. The determination of the concentration and identification limits showed that cerous ions in as small a quantity as 0.5  $\gamma$  in one macro drop can be detected easily with this test.

Co, Cu and V interfere with the test because of the production of blue colour when

their salt solutions are treated with alkali even without the addition of Benedict's reagent. With the exception of certain rare earths, e.g., Gd, Ho, Tm, Dy, Eu, Yb and Lu whose interference has not been so far studied due to the unavailability of their pure compounds, the above test is specific for trivalent cerium. Its applicability to colorimetric and chromatographic determination of cerium is under investigation.

Grateful thanks are due to Professor S. S. Joshi for facilities and constant encouragement during the work and to the National Institute of Sciences of India for the award of a Research Fellowship.

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November 18, 1951.

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### REGIONAL WATER CONTENT OF THE INTESTINAL WALL OF EARTH- WORMS AND ITS SIGNIFICANCE

WITH reference to the difference in the water content of different regions of the body-wall of the earthworm,<sup>1,2,3</sup> it was considered worthwhile to examine the hydration of the wall of the intestine to ascertain if its different regions also exhibit a gradient similar to that in the body-wall.

The intestine of three species of earthworms *Pheretima posthuma*, *Eutyphæus waltoni* and *E. nicholsoni*, from segment XIV or XV upto the anal segment, was taken out and thoroughly dried between filter-papers to get rid of the body-fluids adhering to it. Each piece was then divided into an anterior and an approximately equal posterior part; these two parts were

weighed in tared micro-crystal-glasses and dried in a hot air oven at 100° C. for 2 hours, in which time the weight became constant and remained so for well over 15 hours. The water-content of 100 gm. of the tissue was calculated from these weighings, and the mean of twenty-five estimations for each worm is given in Table I, along with the percentage difference between the anterior and posterior halves of the intestinal wall.

From the figures in Table I it will be observed that the intestinal wall of the posterior half of all the three species of worms examined has a higher percentage of extractable water than its anterior half. The difference in the water-content of the two halves (regions) of the intestinal wall for *P. posthuma*, *E. waltoni* and *E. nicholsoni* is 11.09, 6.40 and 8.44 per cent. respectively: this difference as compared with the difference between the water-content of the middle and posterior regions of the body-wall (0.78 to 1.17%) is of a much larger magnitude. Since the intestine in these worms is confined to post-clitellar region only, the difference in the water-content of the anterior and posterior halves of the intestinal wall has been compared with the difference between the middle and posterior regions of the body-wall. In *P. posthuma* the difference between the two regions of the intestinal wall is 11.09%, while the corresponding difference between the two regions of the body-wall is only 1%.

In all the worms employed for analysis the anterior and posterior regions of the intestine were full of earth, and as the water-content of the intestinal wall of the posterior region was found to be greater than that of the anterior region, it showed that when both the regions are functioning the intestinal wall of the posterior region is richer, and that of the anterior region poorer in its water-content.

TABLE I

	Percentage of water in 100 g. of the intestinal wall				Percentage of water in 100 g. of the body-wall		
	Anterior half of the intestine	Posterior half of the intestine	Difference between the anterior and the posterior halves		Middle or post-clitella region	Terminal or anal region	Difference between the middle and anal regions
1 <i>Pheretima posthuma</i>	52.86	63.95	11.09	Dried over H <sub>2</sub> SO <sub>4</sub> Dried at 100° C.	73.93 73.99	74.95 74.99	1.02 1.00
2 <i>Eutyphæus waltoni</i>	60.56	66.96	6.40		..	..	..
3 <i>Eutyphæus nicholsoni</i>	58.64	67.08	8.44		..	..	..

A likely explanation for such a marked difference is that the anterior half of the intestinal wall is losing water as it secretes digestive juices into the lumen of the gut, while its posterior half is gaining water by absorbing it from the gut contents.\* This is in agreement with the established conceptions regarding digestion of food in the anterior region of the intestine and its absorption in the succeeding region in the higher invertebrates.

It may, therefore, be concluded that there is as much functional heterogeneity in different regions of the intestine of earthworms as there is in the other higher invertebrates, in that its anterior region is secretory and the posterior mainly absorptive.

A complete account of this investigation will be published elsewhere.

I am grateful to Dr. K. N. Bahl for his valuable suggestions and constant encouragement.

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University of Lucknow,  
November 16, 1951.

\* It may be noted that the earthy contents of the anterior region of the intestine are much more fluid and pulaceous as compared with those in the posterior half where they are more solid and compact and form rounded pellets or long winding strings.

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### A COLOUR REACTION FOR CHLOROMYCETIN

SUMNER AND GRAHAM<sup>1</sup> first demonstrated the development of a brown colour on allowing sugars to act upon 2:4 dinitro salicylic acid. The reaction involved is:



This colour reaction has been standardised by von Høstler, *et al.*,<sup>2</sup> for the estimation of mono- and di-saccharides. Based on this reaction, Meyer, *et al.*,<sup>3</sup> have developed a rapid method for determining the diastatic activity of malts.

During a study of the action of antibiotics<sup>4</sup> on amylases, it was observed that chloromycetin and maltose behaved similarly in producing the characteristic reddish brown colour. Intrigued by this finding, various tests for sugars were carried out with chloromycetin. Fehling's, Benedict's, Phenylhydrazine, Molisch, Nyland-

er, Barfoed, Selivanoff, Phloroglucinol and Benzidine tests were negative, whereas picric acid and dinitrosalicylic acid tests were positive with chloromycetin. The colour tests with the last two reagents have been made quantitative for the estimation of chloromycetin. In Fig. 1

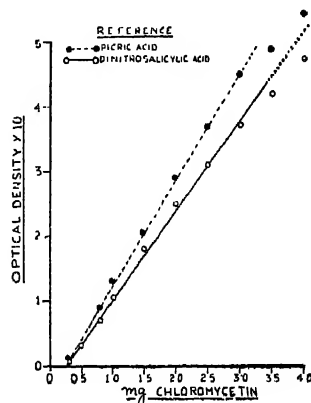


FIG. 1. Standard Curves for Chloromycetin with picric acid and dinitrosalicylic acid.

is reproduced the standard curves for chloromycetin with the two reagents. The tests were carried out as follows: to different concentrations of chloromycetin made up to 2 ml. were added 2 ml. of the colour reagent, the mixture heated in a boiling water-bath for 10 minutes, cooled to room temperature, diluted to 10 ml. and colours read in a Lumetron Photo-electric colorimeter using Green filter (530) against a reagent blank similarly treated.

For the preparation of the colour reagents 1 g of picric acid (Merck) or dinitrosalicylic acid (prepared by direct nitration<sup>5</sup> of salicylic acid) 30 g of Rochelle salt, and 20 ml. of 2 N NaOH were made up to 100 ml., heated in a water-bath cooled, filtered and used immediately.

The colour reaction was found to be sensitive over the range 0.5-3.0 mg of chloromycetin. The applicability of this method in the routine estimation of chloromycetin in biological materials as also the nature of the colour compound formed, are under investigation.

Central Drug K. L. ARORA.  
Research Institute, C. R. KRISHNA MURTI.  
Lucknow, February 7, 1952.

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## REVIEWS

**Essay in Physics.** By the Rt. Hon'ble Viscount Samuel. (Blackwell, Oxford). Pp. 153. Price 7 sh. 6 d.

Recent advances in Physics show unmistakably that while philosophy is turning towards the causes of natural phenomena, physics tends to metaphysical speculation. The greatest triumphs in recent years have been won with the aid of mathematics. On the one hand, the effect has been a tendency to draw 'sweeping philosophical inferences', while on the other, speculations, which have no mathematical proofs and lie in the borderland between philosophy and physics, have been greatly discredited.

It is of interest to consider the distinction between fictional abstraction and physical fact. Unfortunately this distinction is becoming less clear cut in physics. For example, the space-time continuum may account for several observed physical phenomena but it has no objective existence. While undoubtedly inferences have to be drawn from the world of experiment and experience, such inferences must be considered with due regard to their limitations. They should also be elastic enough to suffer alteration in the light of new facts.

The physicist is thinking of measurements of events, but the philosopher is watchful of the events themselves and their ultimate causes. On this basis, the principle of indeterminacy cannot be accepted by the philosopher. The law of chance has no rational basis in an organized universe.

These are some of the ideas developed in this book. On these considerations, some outstanding problems are considered by the author. The nature of electromagnetic radiation and the medium for its propagation, the nature of gravitation, the nature of motion in general and of momentum in particular and finally, the nature of waves and particles are examined in detail in the light of current ideas.

According to the author, energy in the continuum exists in two states, quiescent and active, passing easily from one into the other. Quiescent energy is conceived as the continuum, the sole physical constituent of the universe. All material events are to be accounted for as cases of the activation of quiescent energy.

On these ideas, the foregoing outstanding problems of modern physics are considered and explanations are offered. The Planck constant  $h$  is suggested as the measure of the least impact that changes quiescent energy into active energy.

A letter from Professor Einstein is included in the book. He gives a clear analysis of the superiority of the field-theory as developed in the Special Theory of Relativity over the earlier contributions of Newton, Faraday and Maxwell.

Lord Samuel has shown a clear appreciation of the problems of present-day physics and the difficulties associated with them. While his solution may or may not find general acceptance with philosophers and physicists, there can possibly be no doubt that he has evinced (as Professor Einstein points out) an independence of mind, untrammelled by conventions or codes. The book is thought-provoking and goes to the root of our ideas relating to the structure of the universe. It is sure to be of interest to students of philosophy and physics.

S. R. R.

**Statistics: An Intermediate Text-Book, Vol. II.**

By N. L. Johnson and H. Tetley. (Cambridge University Press), 1950. Pp. xi + 318. Price £ 1.

The present volume as well as the previous one published in 1949, have been written by actuaries and intended as an Intermediate Text-Book, but it is evident that their value will by no means be confined to actuaries, nor to those desiring to learn the elements of statistical theory. Examples are chosen which are relevant to the theory, and there is a great variety of them from actuarial as well as other fields. The outlook of the book is a thoroughly practical one.

The first volume dealt with descriptive statistics and large sample theory, and this volume includes the  $t$  test, the  $\chi^2$  test, the variance-ratio test, analysis of variance, correlation, etc. It can in the main be read by itself, although there are references back to the discussion of confidence intervals in the first volume.

The notation used is noteworthy. It is clear and carefully chosen, carrying out recognised principles. Some new symbols are defined on

p. 41, and a few elsewhere: one which will be very useful is a symbol for 'is distributed as'.

W. F. KIBBLE.

**Sound Insulation and Room Acoustics.** By P. V. Bruel; Translated from the Danish by J. N. Borup (Chapman and Hall), 1951. Pp. xi + 275. Price 35 sh.

Though Lord Rayleigh laid the basis for the science of Acoustics in his classic *Theory of Sound*, it was Wallace Clement Sabine at Harvard who applied the science to the practical problem of acoustical design of buildings, and since then, applied acoustics has been almost a monopoly of American scientists. The book under review, written by an eminent European authority on the subject is therefore doubly welcome as it embodies much of the valuable war-time research that went on in Western Europe and also because it brings a fresh approach to the problem.

The book is divided into six chapters, the first two of which deal with fundamental ideas, including the mechanism of hearing. In the third chapter are developed recent concepts of wave acoustics, particularly in relation to the behaviour of sound waves in a geometrical enclosure. A great deal of experimental data on absorbing materials is included in the next chapter and the sections on resonator absorbers are of special interest as it is sought to use similar devices in this country. The fifth chapter gives copious details on the design of structures for effective sound insulation. The last chapter outlines the main aspects for consideration in the design of acoustically good rooms with particular reference to Broadcast Studios. It is gratifying to find that the problem of Flutter Echo—which often occurs in Radio Studios—has been treated here satisfactorily for the first time.

There are many references to European authors in the bibliography but it is a little surprising to note that there are no references to the work in U.S.A. after 1940.

The author's objective is ostensibly "to give Civil Engineers and architects some idea of the laws of acoustics", but much of the material seems too specialised to be of much use to the practising architect. However, the mass of experimental data one finds in this book will be invaluable to the research scholar and the acoustical engineer actively interested in the design of acoustically perfect buildings.

RAM K. VEPA.

**Elementary Calculus.** By M. Lakshmanamurti (Rao Brothers, Guntur). Pp. xxii + 207. Price Rs. 2-8-0.

This book is particularly well written for beginners. It combines a masterly and lucid exposition of the subject along with the necessary rigour appropriate for this stage. The first chapters dealing with functions, limits, continuity and differential co-efficient can be recommended even to students of B.A. and B.Sc. classes.

The illustrative examples are extremely well chosen and indicate that the author is a teacher of ripe experience of University classes. The question papers at the end of the book also serve a very useful purpose. As a text-book for the Intermediate, this is perhaps easily the best book now available either from the point of view of the student or the teacher.

B. S. MADHAVA RAO.

**Fault Calculations.** By C. H. W. Lackey. (Published by Oliver & Boyd, Ltd.), 1951. Pp. xi + 296. Price 30 sh. net.

The calculation of fault currents and voltages is of the utmost importance for the proper design and operation of electric power systems, and the subject forms a major part of what may be called "Power System Analysis". In the case of large and inter-connected systems, such calculations are nowadays made with ease and rapidity on D.C. calculating boards and A.C. network analyzers. However, an analyzer is not a substitute for brains and a thorough knowledge of the analytical methods of network solution is still essential to the power system designer.

Though several books have already been published on the subject of fault calculations (some of them have been mentioned in the bibliography) the author has tried to lay emphasis on the practical aspects of the subject. Chapters I to IV deal with the fundamentals of fault-calculations, viz., the use of vectors, vector-algebra, impedance-notations, network reduction calculation of balanced faults, symmetrical components and calculation of unbalanced faults. Chapter V is devoted to the subject of the impedances of power system components and an appendix is added containing schedules of impedance-data of generators, transformers, overhead lines and cables for systems operating on 50 cycles. Though such data are easily available for 60 cycle systems in American technical literature, some amount of

difficulty has been felt by power system engineers operating on 50 cycle systems, owing to lack of information on the impedances of power system components. The appendices are therefore most welcome. In Chapter VI a variety of practical problems of power system performance under fault conditions are considered. The book concludes with a chapter on fault-calculators and network-analyzers which are so invaluable for solving power system problems. Brief descriptions of the Universal fault-calculator and the Dual-circuit fault-calculator (Reyrolle), the A.C. network analyzer (Associated Electrical Industries) and the Blackburn network analyzer (Merz and McLellan) all of British make, are included.

There is no doubt that the book would be of immense help both to students and power system engineers; however, one gets a feeling that the book has been written to fill a gap in British technical literature.

The printing and get-up of the book are good but the price seems to be rather on the high side.

H. N. RAMACHANDRA RAO.

**The Intelligent Use of the Microscope.** By C. W. Oliver. Second Edition. (Chapman & Hall Ltd., London, W.C. 2), 1951. Pp. xii + 192. Price 15 sh. net.

Since the first edition of this widely consulted and popular volume was published in 1947, there have been few advances in microscopical technique except for the one revolutionary development pertaining to Phase Contrast Microscopy. This far-reaching contribution to microscopy has been clearly and comprehensively covered by the last and the twelfth chapter of the volume. Those interested in a more detailed understanding of the theory and applications of phase contrast microscopy, will find the bibliography given at the end of this chapter, useful.

The present volume consists of 12 chapters, and practically follows the same plan which distinguishes the earlier edition. Reference is made to the reflecting microscope which is under development but no details are given in view of the circumstance that the instrument is not yet easily available. In a future edition, which we hope, will soon be issued, we have no doubt that an equally illuminating description of this new instrument will be included.

Written by one whose long and uninterrupted experience with a microscope commenced at the young age of seven years, the author is exceptionally qualified to appreciate the "prob-

lems, queries and difficulties" which confront a beginner and to clarify them with sympathy and understanding. This is a volume indispensable to every one interested not only in getting the best out of his instrument but also in maintaining it in an efficient working condition.

**Annual Reviews of Biochemistry.** Vol. XIX.

Edited by J. M. Luck, H. S. Loring and G. Mackinney. (Annual Reviews Inc. Stanford University), 1950. Pp. xi + 596. Price \$ 6.00.

The nineteenth volume of the now familiar and eagerly welcomed series of Annual Reviews of Biochemistry, possesses the usual features which characterise the series. With the inauguration and development of other series of Reviews on Plant Physiology and Microbiology, discussions of many topics of biochemical significance formerly covered by Biochemical Reviews, are being transferred to the new series of volumes. This step has been found both necessary and appropriate in view of the ever-increasing output of work and the rapid expansion and specialisation in the field of biochemistry.

The present volume covers 22 topics; they include Biological Oxidation by V. R. Potter, Proteolytic Enzymes by M. Laskowski, Non-oxidative, Non-proteolytic Enzymes by P. P. Cohen and R. W. McGilvery, Carbohydrate Chemistry by M. L. Wolfrom and J. M. Sugi-hara, Chemistry of Lipids by H. J. Deuel Jr., Chemistry and Metabolism of the Steroid Hormones by G. Pincus, Chemistry of Amino-acids and Proteins by R. K. Cannan and M. Levy, Nucleic Acids, Purines and Pyrimidines by G. Schmidt, Carbohydrate Metabolism by S. Ratner and E. Rackner, Fat Metabolism by G. Medes, Metabolism of Proteins and Amino-acids, by P. P. Swanson and H. E. Clark, Chemistry of the Hormones, by A. White, Water-soluble Vitamins, by E. E. Snell and L. D. Wright, Fat-soluble Vitamins, by T. Moore, Nutrition, by H. M. Sinclair, Muscle, by F. B. Straub, Biochemistry of Neoplastic Tissue, by C. Carruthers, Chemical Composition of Blood Plasma and Serum, by H. A. Krebs, Pyrrole Pigments, by R. Lemberg and J. W. Legge, Immunochemistry by P. Grabar, Biochemistry of Antibiotics, by H. E. Carter and J. H. Ford. The subject of Partition Chromatography whose application to the biochemical problems has spectacularly influenced and facilitated the progress of biochemical research, has been reviewed by A. J. P. Martin.

Extensively supported by references to literature and comprehensively documented with author and subject indices, the volume constitutes an indispensable reference book to investigators in biochemistry.

**Bacterial Physiology.** Edited by C. H. Werkman and P. W. Wilson. (Academic Press Inc., New York), 1951. Pp. 707. Price \$ 8.50.

Here is a fascinating book on bacterial physiology, for advanced students and research workers engaged in the bewildering and rapidly advancing field of biochemistry. The book has been edited by two well-known investigators in the field of microbial physiology and comprises 20 essays on different aspects of the chemistry and physiology of micro-organisms written by reputed workers in the different fields. Knaysi has written on the structure and chemistry of the bacterial cells; Lederberg on inheritance variation and adaptation; Gunsalus, Mitchell and Wyss on the growth and death of bacteria; Snell on bacterial nutrition; Schlenk on bacterial enzymes; Werkman and Schlenk on anaerobic dissimilation of carbohydrates and Barron on bacterial oxidations. The subjects of assimilation of carbon dioxide and nitrogen by different groups of bacteria, mineral metabolism and hydrogen metabolism have been dealt with by authors like Foster, Werkman, Gale, Wilson, Knight and Koffler who have themselves contributed much to the development of knowledge in these fields. There are four chapters devoted to the discussion of some of the latest concepts regarding the assimilative and synthetic activities of micro-organisms, the biological significance of autotrophy and luminiscence of bacteria, etc., etc., and written by Koffler and Wilson, Clifton, Barker and Hassid, Umbreit and Johnson. All the contributors have written in a very illuminating and thought-provoking manner and even if one may not be in entire agreement with some of their views they merit the serious consideration of all readers. Thus instead of a mere compilation of the huge amount of work in the various fields of bacteriophysiology, there has been a judicious sifting of the results and a presentation of the most significant findings so that the post-graduate student and the research worker may get some concrete picture out of the mass of confusing data. There is also a bibliography with which is combined an author index, a subject index, and a micro-organism index. The book is profusely illustrated with graphs, photographs and electron micrographs. The get-up and

printing of the book are excellent. It may safely be recommended as a "must" for the shelf of the research worker, teacher and post-graduate student in bacteriology.

K. K. IYA.

**Pharmacopoeia Internationalis Editio Prima,** Vol. I. (International Pharmacopoeia, First Edition, Vol. I), W.H.O. Supplement 2, 1951. Pp. xviii + 406. Price 35 sh.

It is gratifying to note that the attempts to achieve the unification of terminology and standardisation of drugs, started as long back as 1874, has yielded the desired result in the publication of this volume by W.H.O. under the ægis of United Nations. One cannot lay too much emphasis on the desirability of establishing an international agreement on matters concerning the standards of safety, purity and potency of biological and pharmaceutical products which are of vital importance both to the medical profession and the general public.

In form and general arrangement this pharmacopoeia follows the practice of present-day national pharmacopoeias. Monographs together with the appendices form an authoritative source for specification of drugs and preparations, biological assays and chemical methods.

This work, accomplished by international collaboration is sure to be adopted by the various countries and result in "promoting and protecting the health of all peoples".

M. SIRSI.

**A Text-Book of Plant Physiology.** By P. L. Kochhar. (Atma Ram & Sons, Delhi), 1951. Pp. x + 316. Price Rs. 10.

This book on Plant Physiology is intended to meet the requirements of students preparing for a Degree in Botany or Agriculture. Its eighteen chapters are devoted to a comprehensive treatment of the various aspects of the functioning of the living plant. In a field where a mass of literature has accumulated in recent years and where many controversial problems exist, it is not to be expected that, in a book of this kind, there should be any detailed discussion of them. The author has, however, tried to indicate the trend of modern views in the explanation of various plant functions like the absorption of water and dissolved substances, translocation, etc. The role of trace elements and hormones in the growth of the plant, the problems of drought and frost resistance, vernalisation, all of which find application in agricultural practice, are also referred to in the



text. A welcome feature of the book is the inclusion at the end of each chapter of a set of simple experiments which could conveniently be carried out in the class room. The experimental aspect is often not given the importance it deserves. An appendix gives a series of test questions selected from various University examinations. Barring a few misprints here and there, the printing and general get-up of the book can be considered to be quite satisfactory and the book is one which could profitably be used by the B.Sc. students of our Universities.

M. A. R.

**Elsevier's Encyclopaedia of Organic Chemistry.**

Edited by F. Radt. Series III. Carbocyclic Condensed Compounds, Vol. 14, Supplement. Tetracyclic and Higher Cyclic Compounds except Steroids and Triterpenes. Elsevier Publishing Co., Amsterdam, 1951. Pp. 1 S-938 S. Price not given.

Vol. 14 of Elsevier's Encyclopædia, which appeared in 1940, consisted of 711 pages and covered the literature on carbocyclic compounds containing four or more rings, including the steroids. Work on compounds of these types, especially from the point of view of their carcinogenic and other physiological properties, has been proceeding on such an extensive scale that a supplement in two volumes has become necessary to deal with the literature during the decade 1936-46. In these ten years, not only has our knowledge of the known ring systems undergone considerable expansion, but compounds belonging to as many as 145 new ring systems have also been synthesized. The volume under review is Part I, and it excludes the steroids and triterpenes, which are to be treated in a subsequent volume as Vol. 14, Supplement, Part II. The number of pages devoted to 1:2-benzanthracene, cholanthrene and 3:4-benzpyrene has increased from 14 to 130, from 2 to 37, and from 2 to 64, indicating the extent of the literature on these and similar carcinogenic compounds which has appeared between 1936 and 1946. Patent literature, excluded from the Main Volume, is covered in the Supplement. The criticism made in an earlier review (*Current Science*, 1950, 19, 329) regarding this separation of patent and other literature has been largely invalidated, and the usefulness of Elsevier's Encyclopædia greatly increased, by the appearance of supplements embracing patents. An important feature of the Supplement to Vol. 14, which will also be found in the supplements to other volumes, is that the

survey of the methods of formation of each ring system, occurrence of compounds in nature, summaries of the ring systems, the summarized data on compounds, and the subject and formula indices consolidate the main and supplementary volumes. Thus a reference to the Supplement is adequate for tracing all the literature up to 1946 on a given compound or ring system.

No chemical library can afford to do without Elsevier's Encyclopædia. It is to be hoped that the main volumes of the entire series will be completed during the next few years and that decennial supplements will continue to be published at regular intervals.

K. V.

**Nomographic Charts.** By C. Albert Kulmann. (McGraw-Hill), Pp. 244. Price \$ 6.5.

Nomograms are well known for the ease of operation in solving both scientific and technical problems within the shortest period of time. There are a number of books which deal with nomograms but they confine themselves to some particular subject. The book under review is more of a general nature and covers a much wider field for the scientist as well as the engineer, and will be found very useful in the design office where a lot of calculations are involved.

The book is divided into six sections. The first two deal with general mathematical formulæ, like the determination of roots, powers of numbers, areas of circles, reciprocals and reciprocal sums, etc. Chapter III is concerned with hydraulic charts which are very useful for determining the velocity against head, conversion of water-pressure, discharge over weir under varying conditions, flow in pipes and open channels, etc. The charts relating to turbine and pumps and rainfall intensity and run-off are very interesting and useful. Chapters IV, V deal with problems commonly met with in mechanics and thermodynamics. The last chapter contains charts for use in electrical engineering problems whose solution is considerably facilitated with the help of these charts.

The book gives clear and detailed instructions regarding the use of each chart, though the mathematical background is not given. These charts are very useful where slide rule methods cannot be used readily. The get-up and printing are quite attractive. The book should find a place in all technical and scientific libraries.

K. SEETHARAMIAH,

## SCIENCE NOTES AND NEWS

### Symposium on the Rajputana Desert

The National Institute of Sciences of India are holding a Symposium on "The Rajputana Desert" in Delhi on 7th, 8th and 9th March, 1952. The Symposium will deal with all aspects of desert science, climate, soil, water, solar energy, biology, etc. The subject is of great national importance and invitations have been issued to all interested Governments and specialists. Any person not invited by name will be most welcome if he takes part in the Symposium or sends papers to the Convener: Dr. S. K. Banerji, D.Sc., F.N.I., College of Engineering and Technology, Bengal; Jadavpur, Calcutta 32. Papers on specified subjects will be received for a short time after the Symposium for inclusion in a Bulletin to be issued by the National Institute.

### Symposium on Paints and Varnishes

A Symposium on Paints and Varnishes will be held under the auspices of the National Chemical Laboratory of India, on March 6 and 7, 1952. It is proposed to divide the Symposium into the following broad sections: (1) Raw materials for varnishes; drying and treated oils, resins, driers, solvents and thinners. (2) Pigments, metallic powders and metallic soaps. (3) Manufacture and testing. (4) Recent developments and special purpose coatings. Those intending to take part are requested to communicate with Shri. K. K. Sarin, National Chemical Laboratory, Poona 7.

### Assistance from Ford Foundation

Under the agreement now signed between the Government of India and the Ford Foundation, the latter will assist in financing, partly, the first five training centres for rural extension service and the 15 intensive development areas which are to be set up. In general, the financing of the intensive development areas will be done by the Government of India and the States. To the extent, however, that such assistance can accelerate the initiation of development work, the Ford Foundation will provide the finance.

The Foundation will also consider (a) the furnishing of financial assistance to sound extension training programmes at a few carefully selected higher educational institutions, and

(b) the furnishing of assistance to the Government of India and the States in evaluating various efforts now under way or planned.

### Synthesis of Diamonds

Significant progress in the production of synthetic diamonds was reported at the Twelfth International Congress of Pure and Applied Chemistry by Dr. William O. Baker and Dr. Field H. Winslow of the Bell Telephone Laboratories. Hard spheres of carbon which will scratch glass surfaces have been made by subjecting the chemical polydivinyl benzene to very high temperatures. The new form of carbon is somewhere between graphite and real diamonds. Because of their great purity and uniformity, the spheres can be used in making carbon rods in atomic piles. The hardness and abrasive quality of powdered polymer carbon suggests its use in grinding and polishing operations, and in replacing diamond dust in some cases. The carbon pellets are also semi-conductors and may find many uses in modern electronic equipment. The diameter of the carbon sphere varies from as little as one-millionth of an inch to about one-sixteenth of an inch.

### Bombay Veterinary College—Diamond Jubilee

The Diamond Jubilee Celebrations of the Institution were celebrated on 25th December, 1951, when Dr. S. Datta, Director, Indian Veterinary Research Institute, presided. In the course of his presidential address Dr. Datta emphasised that veterinary education should no longer be on the old stereotyped system of concentrating on diseases and parasites, but should be on the normal physiological aspect of health and productivity. It must be realised that the animal is a complex biological entity which results from its own heredity and factors of management like nutrition and environmental conditions. The best account can be given by an animal only by the co-ordinated function of all its organs and tissues and by a proper adjustment to factors characterising each environment.

### Plastic Lenses Inside the Eye

A report from a British eye specialist in a recent issue of *Lancet* says that a lens in plastic

material can be inserted into the eye in place of the diseased lens at the time of the extraction or at a second operation. The new lens is, of course, not a copy of the human lens, nor can it replace entirely the delicate adaptable structure which normally serves for focusing purposes, but it is reported to work in a way that "closely and consistently reproduces the normal". Twenty-five eyes have been operated upon with the insertion of a plastic lens. The first two cases were unsatisfactory and of the remaining 23, one gave trouble. It is thought that the new lens can remain in an eye for at least two years without causing irritation.

### Training in Quality Control

An agreement has recently been signed by the Government of India with the United Nations Technical Assistance Administration for training in Statistical Quality Control. Under this agreement U.N. Technical Assistance Administration will provide the services of a Director and three expert Lecturers for a period of three months and an Executive Secretary for a period of four months. The Government of India have agreed on their part to meet the local expenses of the experts to the extent of Rs. 50,000. This scheme is being sponsored by the Central Statistical Organisation under the Cabinet Secretariat of the Government of India. They will arrange for the attendance of 25-30 suitable students at each such training centre organised during the period.

### Scientific Material Purchases with UNESCO Coupons

Orders to the U.K. should be addressed to: The Scientific Instrument Manufacturers' Association of Great Britain, Ltd., 20, Queen Anne Street, London W1.

Enquiries for sources of supply in the U.S.A. of radio parts and accessories and of electronic equipment may be addressed to: The National Appliance and Radio Dealers' Association, Merchandise Mart, Chicago 54, Illinois, U.S.A. These organisations will then designate a suitable dealer for each enquiry.

### British Commonwealth Collections of Micro-Organisms

A Directory of collections of micro-organisms maintained in the British Commonwealth and a list of species obtainable from them has been published by H. M. S. O. (Price 5 sh.; by Post

5 sh. 3 d.). Details of 91 collections are given, with the types of organisms held and whether they can be obtained on request, on payment of a fee, or as a personal favour.

The list of species is divided into sections corresponding to the different branches of micro-biology and includes algæ and protozoa, bacteria, fungi, viruses and bacteriophages and yeasts. Opposite each species name there are the code numbers of collections maintaining the organism, from which full particulars can be found.

### Journal of Scientific and Industrial Research

With the issue of the January 1952 Number, the J.S.I.R. published by the Council of Scientific and Industrial Research (Ministry of Natural Resources and Scientific Research, Government of India), enters the 11th year of its publication. Since its first appearance as a quarterly in 1942, the progress of the Journal has been continuous, *pari-passu* with the expansion of the activities of the Council. In view of the increasing number of scientific articles received for publication, the Editorial Board have decided to increase the number of pages per issue of the Journal. Our heartiest good wishes for the future progress of the Journal.

### Award of Research Degree

On the recommendation of Boards of Examiners consisting of Professors Sir E. K. Rideal, A. J. Allmand, Sir S. S. Bhatnagar and S. S. Joshi, and of Professors W. E. Garner, Sir J. L. Simonsen and K. Banerji, the Degree of Ph.D. of the Banaras University was conferred on Messrs. K. Seshadri and S. M. Deshpande, for theses entitled, "Electro-Chemical Preparation of Hydrogen Peroxide" and "Production of Joshi Effect in CO, CO<sub>2</sub> and Organic Vapours".

The University of Poona has awarded the Degree of Doctor of Philosophy in Agriculture to Mr. S. L. Manjarekar for his thesis entitled "Rickettsiosis in Sheep and Goats in the State of Bombay".

### ADDENDUM

Vol. 21, No. 1, p. 10: In the note on 'Estimation of Phenolphthalein', read sodium bicarbonate (saturated solution) for sodium bicarbonate.

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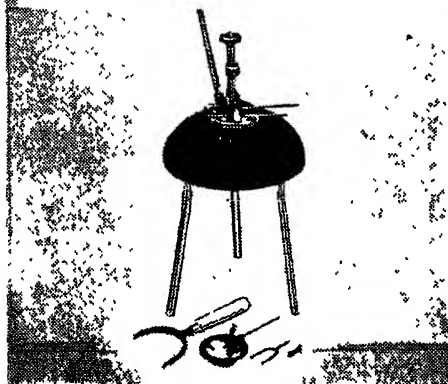
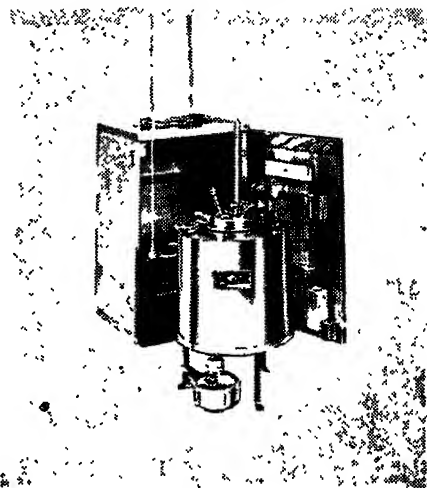
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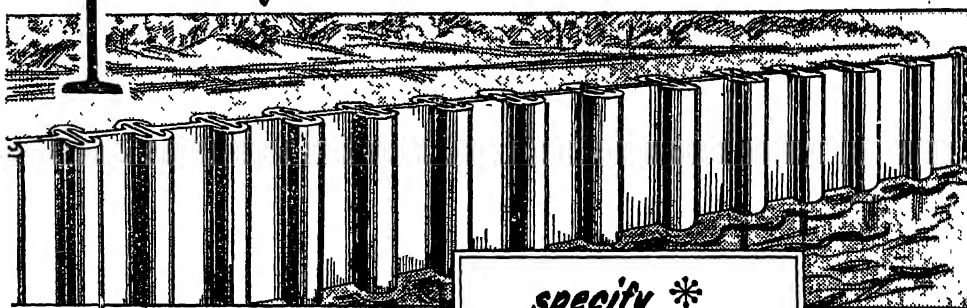
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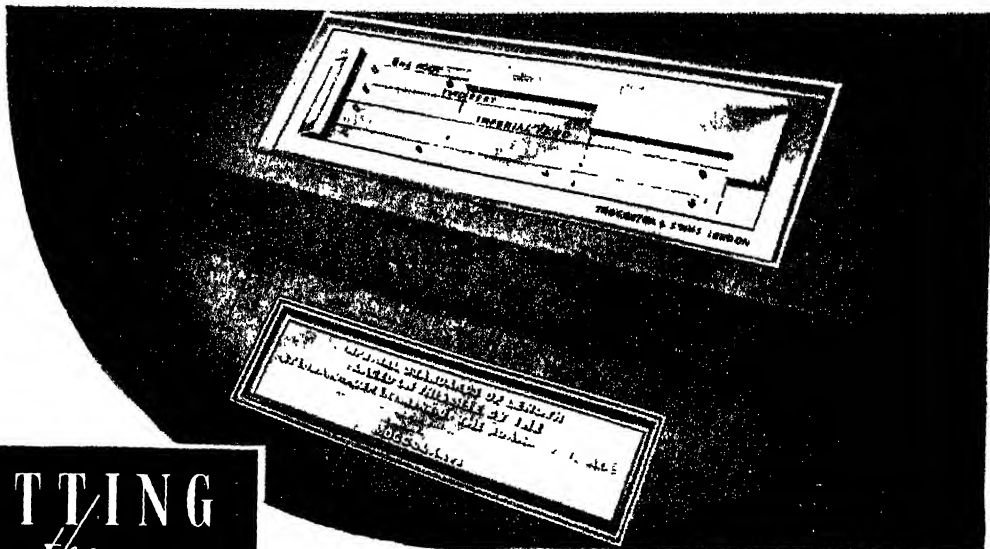


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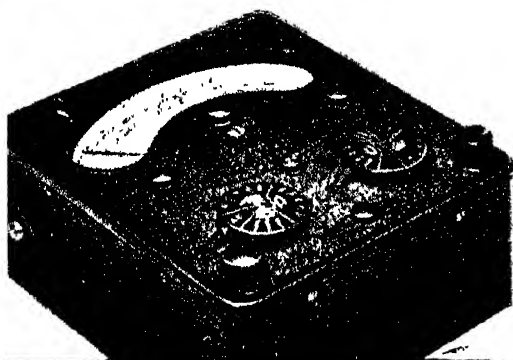


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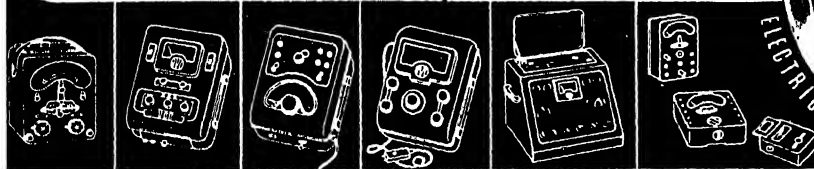


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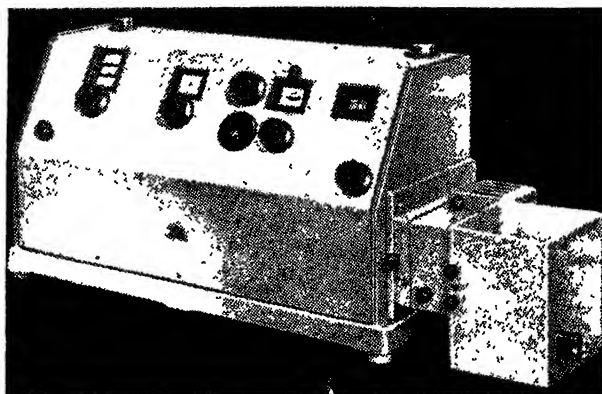
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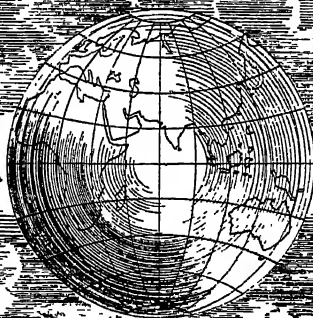
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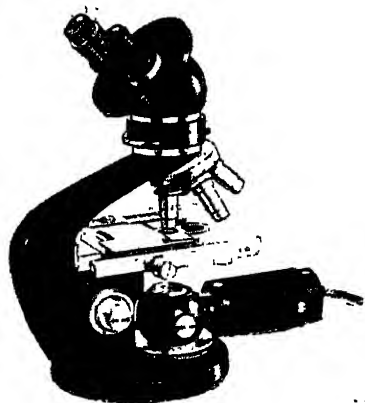
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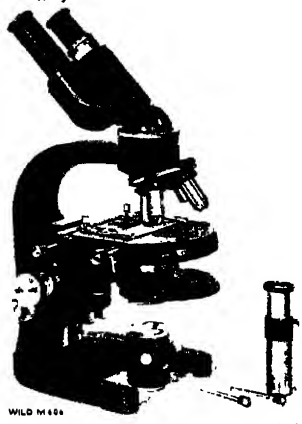
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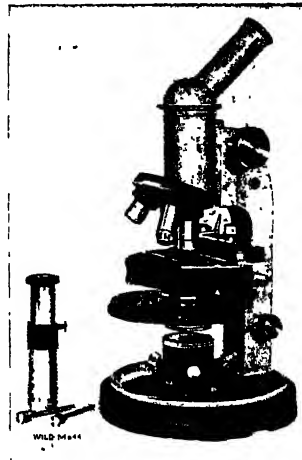
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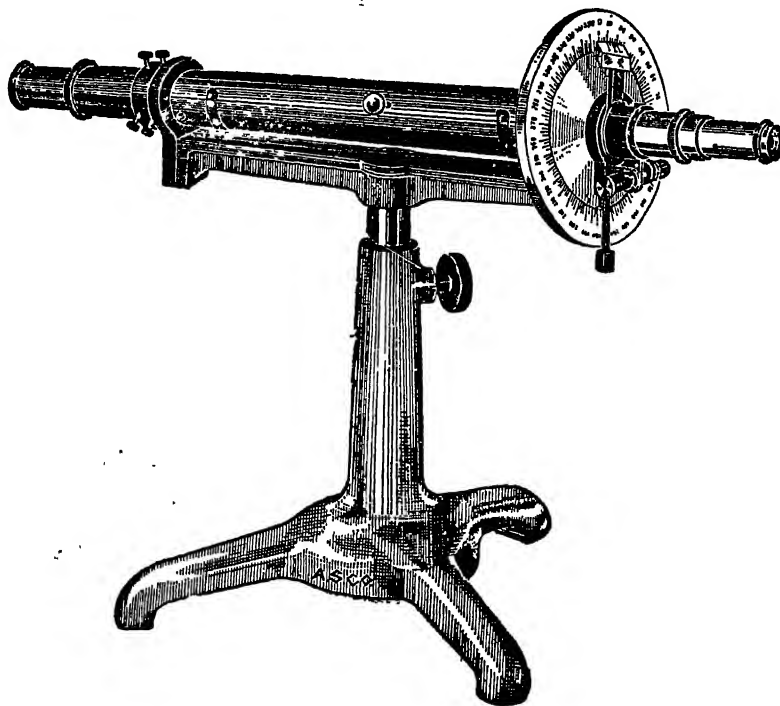
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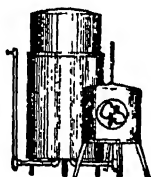
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## SCIENCE AND HUMANISM

**S**PEAKING on the relations between science and human life in his Convocation Address to the Dacca University in 1932, Prof. Sir C. V. Raman observed that a false sense of values underlies the common belief that science derives its justification by its power to create wealth and new comforts and conveniences for humanity. But since science is equally capable of furnishing methods for the large-scale destruction of our civilisation, its true justification is to be sought in the marvellous success it has achieved in opening out a new vision of the universe, and more specifically in enabling man to perceive himself in proper relation to the universe he lives in.

In the course of a series of four lectures delivered at the Dublin Institute for Advanced Studies and published recently under the title "Science and Humanism", Professor Erwin Schrodinger has strongly emphasised the idealistic function of science and its spiritual bearing on life.\* Schrodinger observes that the

practical achievements of science in the fields of technology, industry and engineering are more or less tending to obliterate its true import. Perhaps the fact that true scientific education is not much in evidence explains why a great majority of people seek to limit the goal of all scientific endeavour to just the improvement of our material conditions.

Schrodinger differs from the views of what he calls the "very scientific" circles, who make a virtue of the necessity for specialisation, and claim that the scope, aim and value of science is to be sharply distinguished from those of the other disciplines, such as art, philosophy and religion. In his opinion, the isolated knowledge obtained by a group of specialists within a narrow field has in itself no value whatsoever, but only in its synthesis with all the rest of knowledge, and only inasmuch as it really contributes in this synthesis towards answering the ultimate question: "Who are we?"

In the light of the fact that humanistic circles rarely, if ever, concede to science the right to answer the really important questions arising out of Life, the above pronouncement is indeed doubly welcome. Not only will the answer to the greatest of questions posed in the foregoing be incomplete without the contribution from science, but it is also made clear that science

\* The first lecture deals with this aspect; the other three contain a masterly review of the state of 'Physics in Our Time', particularly in relation to the principle of causality, the question of impossibility of continuous observation and the inadequacy of "models" in describing the ultimate structure of Nature (*Cambridge University Press, 1951*).

cannot rise to its fullest stature, except by attempting to contribute its legitimate share in regard to every such question.

However, Schrodinger admits: "Not that we can avoid specialisation altogether: that is impossible if we want to get on". But he adds that all specialised research has real value only in the context of the integrated totality of knowledge. It is therefore gratifying to learn from him that the awareness that specialisation is not a virtue but an unavoidable evil is gaining ground, and that the voices are becoming fainter and fainter that accuse a man of dilettantism who dares to think and speak and write on topics that require more than the special field for which he is "licensed", or "qualified".

In this connection, it occurs to us that the counterpoise to specialisation is most effectively provided for by having more balanced courses in the Universities. As an example of what can be done in the beginning stages by our University lecturers, the following extracts from the report of the Commission for University Reform in Germany are worth quoting.

"Each lecturer in a technical University should possess the following abilities:

(a) To see the limits of his subject-matter.

In his teaching, to make the students aware of these limits, and to show them that beyond these limits forces come into play which are no longer entirely rational, but arise out of life and human society itself.

(b) To show in every subject the way that leads beyond its own narrow confines to broader horizons of its own."

It is the rounding off at the advanced research stage that raises great difficulties. It is obvious that for this to become fruitful at all, we need to have on the rolls of our Universities men distinguished no less for their catholicity and range of interests than for their scientific worth.

Let us hope that to some at least of our Universities it will be given to discover men who can with confidence preach and practise the following commandments of Schrodinger's: "Never lose sight of the role your particular subject has within the great performance of the tragic-comedy of human life; keep in touch with life—not so much with practical life as with the ideal background of life, which is ever so much more important, and *keep life in touch with you.*"

## INTERNATIONAL STATISTICAL CONFERENCES, 1951

THE Twenty-Seventh Session of the International Statistical Institute (the third after the Second World War), was held in Delhi from 5th to 11th and then in Calcutta from 16th to 18th of December. About 175 delegates from forty-two foreign countries and nine international organisations and a large number of Indian statisticians were brought together to discuss statistical problems in relation to Agriculture, Economics, Demography, Sociology and other Allied Sciences and Humanities.

Several international organizations affiliated to the International Statistical Institute, like the Biometric Society, the Econometric Society, the Association for Research in Income and Wealth and the International Union for the Scientific Study of Population also held special meetings jointly with the International Statistical Conference. The International Statistical Association for Asia and the Far East met in Calcutta and discussed the possibility of expanding their activities in the near future.

The Sampling Subcommittee of the United Nations also met in Calcutta immediately after

the conferences and discussed a number of problems arising out of large-scale sample surveys.

Among the major problems considered at the Conference were the development of national statistical systems in general, and in particular, of vital statistics, agriculture, population, labour statistics, education, and industrial statistics. The reports from various countries and organisations were read and critically examined by the experts. Besides these, there were about 155 contributed papers, many of which were taken up for discussion. There were also a number of papers on theoretical statistics.

Some of the special features of the Conference were field trips to villages near Delhi and Calcutta to study the sampling techniques followed in India for agricultural surveys and economic enquiries, visits to various statistical organisations and popular and semi-technical lectures by distinguished statisticians.

The Conference was followed by a number of seminar lectures which included addresses by Professors J. B. S. Haldane, R. A. Fisher and other distinguished persons.

C. R. Rao.

PROBABLE REGIONS OF "JET" STREAMS IN THE UPPER AIR  
OVER INDIA

P. R. KRISHNA RAO

(Regional Meteorological Centre, Madras)

FROM an examination of the normal meridional cross-sections of pressure, temperature and wind for every 20 degrees longitude over the Northern Hemisphere, Namias and Clapp<sup>1</sup> have given maps for January and July showing the average position and strength of the "jet" stream. These maps show a "jet" axis in January over North India at latitude 22°-25° N. while no such axis is shown over India in July. It appears possible from the normal upper wind pressure and temperature distribution over India to get an idea of the probable regions and heights where jet streams are likely to occur in the upper air over India.

Fig. 1 shows the normal distribution of temperature and the mean zonal west and east components of winds, determined from pilot balloon ascents, in the upper air over India along 78° E. in summer (monsoon) and winter. The temperature distribution is based on Indian Sounding Balloon data and the distribution of west and east components of winds have been

taken from Venkiteshwaran's<sup>2</sup> diagrams with slight modification in respect of winds over South India above 16 km. on the basis of later data. The following conclusions can be drawn from an examination of this figure.

(a) *In Summer (Monsoon).*—(i) Between latitudes 5° N. and 18° N., easterly winds increase rapidly with height above 10 km., reach a maximum of 40 metres per second (88 m.p.h.) between 7° N. and 15° N. at 16-18 km., near the tropopause, and decrease with height above 18 km. Thus, there is a well-marked vertical wind shear in these latitudes (5° to 18° N.) above 10 km. but very little horizontal wind shear. (ii) Between the equator and 5° N. and between 18° N. and 27° N. there is, above 10 km., a well-marked horizontal wind shear but very little vertical wind shear. In these latitudes, the highest wind speed in summer is apparently not reached at the tropopause but at some different height.

(b) *In Winter.*—(iii) Between latitudes 10° N. and 18° N. there is a well-marked horizontal wind shear above 6 km. with westerly winds but very little vertical wind shear. In this latitude range also, the highest wind speed in winter is apparently not reached at the tropopause but at some different height. (iv) Between 18° N. and 30-35° N., there is both horizontal and vertical wind shear, with westerly winds. The vertical wind shear is most prominent and well marked between 22° N. and 32° N. above 10 km. The westerly winds increase in speed with height, reaching a maximum of 40 metres per second (88 m.p.h.) at a height of 12 to 14 km. between 25° and 30° N., and decrease with height above 14 km. It is thus seen that in these latitudes (25° to 30° N.) the maximum wind speed is reached at a height of 2 to 3 km. below the tropopause.

(c) Both in summer (monsoon) and winter, the regions in which there is marked vertical wind shear are separated by regions where there is marked horizontal wind shear. The marked horizontal wind shear is cyclonic to the north and anti-cyclonic to the south of the region of marked vertical wind shear.

3. As 'Jets' are narrow streams of air of small vertical extent, confined to a few degrees of latitude, with well-marked vertical wind shear with decrease of wind speed above and below them and with well-marked horizontal wind

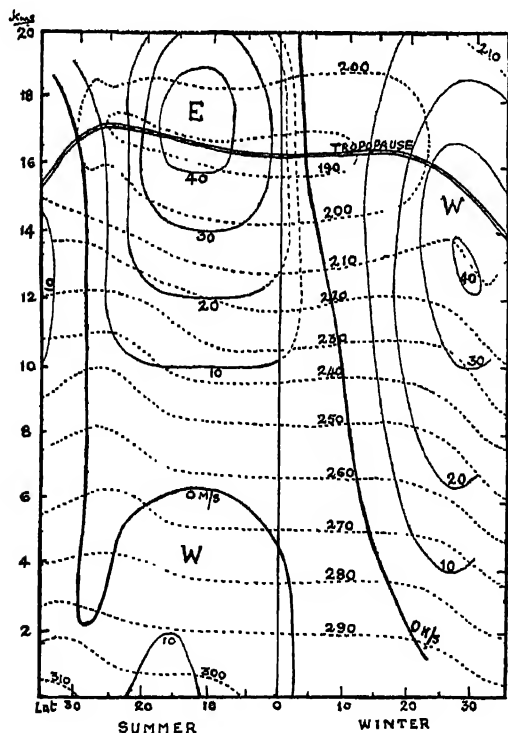


FIG. 1. East-West components of winds in m/sec. are shown by continuous lines and temperatures °K by dotted lines. Tropopause is shown by a double line.

shear to the north and south of them, it seems (para 2) that 'jet' streams are most likely to occur in the following regions over India.

(a) Between latitude  $5^{\circ}$  N. and  $18^{\circ}$  N. in the south-west monsoon season near about the tropopause (16 to 18 km.) and specially between  $7^{\circ}$  and  $15^{\circ}$  N., the 'jet' wind will be easterly. (b) Between latitude  $22^{\circ}$  and  $32^{\circ}$  N. in winter, at 12 to 14 km., specially between  $25^{\circ}$  and  $30^{\circ}$  N., the 'jet' wind will be westerly.

4. It is known that a 'jet' stream is associated with a concentration of horizontal temperature gradient below it and occurs in a field of pronounced baroclinity. Horizontal temperature gradients calculated from Indian Sounding Balloon data over different latitudes show that there is a concentration of positive horizontal temperature gradients (i.e., temperature increasing with latitude) below region (a) i.e.,  $5^{\circ}$  to  $18^{\circ}$  N. in the summer (monsoon) and of negative horizontal temperature gradients below region (b), i.e.,  $22^{\circ}$  to  $32^{\circ}$  N. in winter. This can also be seen from the slope of the isotherms in Fig. 1 which also indicate pronounced baroclinity in the regions (a) and (b).

5. It is seen further that region (b) covers the range of latitudes over which the transition from the tropical to the polar stratosphere occurs in winter. In this range of latitudes in winter, e.g., over Agra (Lat.  $27^{\circ}$  N.), the double type of tropopause is fairly frequent and there are also a number of occasions when the polar type of tropopause occurs there at a height of 11 to 12 km. It is also interesting to note that both regions (a) and (b) occur over latitudes where pressure is highest at the surface in the respective seasons. Palmen<sup>3</sup> has shown that "the strongest west wind in the upper troposphere must be observed almost vertically above the sub-tropical high pressure belt, i.e., around latitude  $30^{\circ}$ ." This is found to be true over India and it is found further that the strongest east winds, in the summer (monsoon) near the tropopause, also occur vertically above the region of highest pressure at the surface over India.

6. While the existence of a westerly jet over the middle latitudes has been recognised and studied by various authors, notably by Palmen and co-workers, an easterly jet such as might occur in region (a) above near the tropopause has not so far been announced. In the meridional cross-section for summer along longitude  $80^{\circ}$  W. given by Hess<sup>4</sup> and that for August-September over the tropical Atlantic given by Vuorela,<sup>5</sup> concentration of easterly winds is shown just above the tropopause over the tropical latitudes. It is seen that over India a

region of strong easterly winds with the characteristics of a 'jet' exists near the tropopause over latitudes  $7^{\circ}$  to  $15^{\circ}$  N. All indications therefore point to the existence of an easterly jet at or near the tropopause in summer over the low tropical latitudes. Examination of some high pilot balloon ascent data on a number of consecutive days over stations in South India below latitude  $15^{\circ}$  N. points to the existence of an easterly jet at 16 to 18 km. on individual occasions. On some occasions, the easterly winds have reached speeds of 80 to 90 metres per second (175 to 200 miles per hour).

7. Chaudhury<sup>6</sup> has discussed the existence of two westerly jets in winter over India near about the 200 mb. level (i.e., at about 12 km.), a "Himalayan Jet" at latitudes  $30^{\circ}$  to  $35^{\circ}$  N. and an "equatorial jet" at latitudes  $15^{\circ}$  to  $20^{\circ}$  N. The "Himalayan" jet occurs in region (a) above but the possibility of the "equatorial" westerly jet is not indicated by the normal wind, temperature and pressure distribution. It appears probable that Chaudhury's equatorial westerly jet is not a separate jet with marked vertical wind shear both above and below it, but is a concentration of westerly winds in the southern edge of the wind field of the 'Himalayan' Jet. Yeh<sup>7</sup> discussing the circulation of the high troposphere over China in winter also finds a westerly 'jet' at about latitude  $30^{\circ}$  N. but not another westerly 'jet' to the south of it.

8. It has been pointed out by Palmen<sup>3</sup> that the jets seen on the mean meridional cross-sections are not identical with "meandering" jet streams associated closely with polar front disturbances and that the latter phenomenon can hardly be studied by the aid of climatological data. While this may be so, there can be no doubt that the regions of about  $10^{\circ}$  latitude width, where mean 'jet' streams are shown, are the most likely regions where "meandering" jet streams will occur although in individual cases the jets may occur at different positions and heights, and with greater intensities than indicated by the highest mean wind speed within the mean "jet" region.

A detailed study of the subject is being made and the results will be published separately.

1. Jerome Namias and Jerome F. Clapp. *J. Met.*, 1949, 6, No. 5, Pp. 330.
2. Venkiteshwaran, S. P.. *Mem. Ind. Met. Dept.*, 1950, 28, Part II.
3. Palmen, E., *Quart. J. Roy. Met. Soc.*, 1951, 77, Pp. 337.
4. Hess, Seymour, L., *J. Met.*, 1948, 5, Pp. 293.
5. Vuorela, Laouri, A., *Ibid.*, 1948, 55, 115.
6. Chaudhury, A. M., *Tellus*, 1950, 1, No. 1, Pp. 56.
7. Yeh, T. C., *Ibid.*, 1950, 2, No. 3, Pp. 173.

## OPTICAL INSTRUMENTS\*

IN the bewilderment caused by the recent advances in atomic physics and electronics, the scientist is apt to overlook the role of optics in modern scientific and industrial development. The important contributions made by optics to such development is brought home by these *Proceedings of the London Conference on Optical Instruments* held jointly with the International Optical Commission.

Photographic and projection lens manufacture, so important in aerial telephoto and wide-angle recording, received its due share of attention and a new zoom lens of variable focus has come into regular use. A new feature in the development of microscopy is the introduction of the reflecting microscope, which has a double advantage of greater achromatism and longer working distance. The ever-increasing demand of the biologist to study, not merely the structural outlines, but the detailed internal constitution of their objects of investigation, is met by the design of the phase-contrast microscope. In the ultra-violet region, the problem of imperfect achromatism is solved by the introduction of fused quartz-fluorite objectives which give virtual images, which are rendered real by their combination with spherical mirrors which are inherently achromatic.

In the field of spectroscopy, a new feature is the Echelle spectroscope whose performance lies intermediate between the *diffraction grating* and the Michelson *Echelon* in respect of resolution of spectral lines and concentration of light into one order. New types of mounting of gratings with additional mechanical and optical advantages are also designed. Spectrophotometry, which was till recently a laboratory technique for chemical analysis, has found important application in industry. Rapidity of

work combined with high accuracy of the results obtained, which are so important for industrial concerns, are both achieved by the latest types of spectrophotometer in which are incorporated compact and complicated optical, photoelectric and electronic assemblies, in addition to mechanical devices for automatic recording. The range of investigation is also extended far beyond the visible region into the infra-red and ultra-violet.

The problem of designing a coma-free astronomical reflector of large aperture and large field is now solved by the new Schmidt camera in which the aberrations of the spherical reflector are corrected by the introduction of a thin, nearly plane-parallel corrector plate placed in an aperture stop at the centre of curvature of the mirror. A new 98-inch telescope incorporating the latest optical and mechanical features is under erection at the new site of the Greenwich Observatory and the final results will be awaited with great interest. Reflecting telescopes are replacing the refractors in the smaller theodolites and binoculars also on account of their greater freedom from chromatism.

New types of testing equipment for determining transmissions of optical instruments are also discussed. Synthetic optical crystals and plastic glasses are new sources of raw material in optical technology which seem to open up new methods of scientific investigation.

The *Proceedings* which report the above developments in optical instrument designs, are thus of interest to the biologist, the astronomer, the spectroscopist and the industrialist. The discussions that followed each of the papers read, are highly illuminating as the contributors are all experts in their respective fields of optical research. All the topics dealt with are fully illustrated. The get-up of the book is good in respect of both arrangement of subjects and their general presentation.

I. RAMAKRISHNA RAO.

## WATUMULL ESSAY COMPETITION RESULTS

THE following are the prize-winners in the Essay Competition on "Population Control in Relation to Food in India": Dr. A. R. Mehta, Retired Deputy Director-General of Health Services, Government of India (Rs. 3,000); Dr. S. Ranganathan, Nutrition Research Laboratories, Coonoor (Rs. 1,000); Mrs. Kamalini Kulkarni, Poona (Rs. 500); and Dr. B. P. Ghosh, Calcutta (Rs. 200).

Six prizes of Rs. 100 each have been awarded to Mr. Pravakar Sen, Government College, Darjeeling; Nikhil Ranjan Banerjee, Cuttack, Orissa; Dr. Moreshwar Patwardhan, District Belgaum, Bombay; Mr. Padmarabhan Nair, Farook College, Malabar; Anikendra Mahalanobis, Calcutta, and Arun Krishna Banerjee, New Delhi.

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## THE COMPLEX BAND SPECTRUM OF NICKEL CHLORIDE

The band spectrum of the diatomic molecule nickel chloride ( $\text{NiCl}$ ) extending from 4,900–3,800 Å has been obtained using a heavy current discharge from a 2 K.W. D.C. generator. The general appearance of the bands is that of well separated close sequences. All the sequences reported by More<sup>1</sup> are observed. Among the four systems identified by More, the additional band heads newly recorded have led to a considerable extension of these systems. For systems 3 and 4, the observed additional sequences have led to the necessity of adopting a different assignment of O, O heads and a renumbering of  $v'$ ,  $v''$  values. Besides the four systems mentioned by More, four new ones have also been identified among the bands. For the eight systems recorded, the following vibrational constants have been obtained from the band head data.

System	$\nu_e$	$\omega_e'$	$\chi_e'\omega_e'$	$\omega_e''$	$\chi_e''\omega_e''$
1	22749.2	398.9	1.03	421.5	0.51
2	23230.7	398.0	0.25	415.9	0.35
3	23342.3	401.4	0.43	416.4	0.48
4	24224.6	400.7	0.60	416.1	0.40
5	21253.5	403.3	0.75	418.5	0.50
6	21756.7	402.9	0.30	421.1	0.89
7	21920.5	404.4	1.16	422.5	0.25
8	24336.5	401.1	0.52	416.4	0.27

The band systems show a complex intensity distribution; probably high multiplicity terms are involved in the electronic transitions.

A complete discussion and details of the analysis will be published elsewhere.

Dept. of Physics, V. G. KRISHNAMURTY,  
Andhra University,  
Waltair,  
October 1, 1951.

<sup>1</sup> More, K. R., *Phys. Rev.*, 1938, 54, 122.

# TERM VALUES IN THE $F^3$ ELECTRON CONFIGURATION

ONLY last week we noticed a letter with the same title by V. Ramakrishna Rao,<sup>1</sup> who calculated the term values of the configuration  $f^3$  by the classical method of Slater<sup>2</sup> and found some discrepancies with our previous results.<sup>3</sup>

The main source of these discrepancies seems to be a misinterpretation of the Tables of Condon and Shortley:<sup>4</sup> the quantities  $a^k$  and  $b^k$  defined by Slater are always fractions for  $k > 0$ , but it was found convenient by Condon and Shortley to treat them as integers by associating the common denominator of several related values with the corresponding F or G. For this reason the common denominator is printed but once at the beginning of each group; but it is understood that it should be maintained for the whole group if Slater's  $F^k$  are used, and it should be cancelled for the whole group if the new  $F_k = F^k/D_k$  are used.

The example of  $^2L$  given by Rao shows that he maintained the denominators for the coefficients of the first row, and only for them. By cancelling the denominators in Rao's Table, and also correcting some obviously misprinted signs in both sides of the Table, almost all the discrepancies are eliminated.

The remaining difference of  $-200 F_6$  in  $^4D$  seems to be due to an error of summation, and causes an error of  $+200 F_6$  in his value of  $^4S$ . We were unable to guess the source of the error in the calculation of ( $^2D$ ); but our value seems to be correct, as it is checked also by an independent calculation.<sup>5</sup>

As for the "discussion" of the "discrepancies", we do not see any reason, why  $^4F$  and  $^4S$  could not have equal energies in this approximation; similar cases are already known in the literature, as  $^2P$  and  $^2H$  in the  $d^3$  configuration<sup>4</sup> and  $^2S$  and  $^4S$  in the  $d^3p$  configuration.<sup>3</sup> The empirical law that terms with lesser L should be higher holds only in a few simple configurations and does not hold at all in  $f^3$ , where  $^4F$  and  $^4S$  are lower than  $^4G$  and  $^4D$ .

The Hebrew University,  
Jerusalem,  
Israel,  
January 11, 1952.

GIULIO RACAH.

# KAEMMERERITE FROM KONDAPALLE KISTNA DISTRICT

DEPOSITS of chromite occur in the Kondapalle range of hills, Kistna District, in association with ultra-basic charnockites and are being worked for over ten years now. A detailed investigation of the area which is in progress has revealed the occurrence of k  mmererite, the chrome-bearing variety of chlorite, in association with the ore bodies. The mineral is seen inside and alongside the bands of serpentine and pale yellow-green serpentinitised pyroxene which generally surround the lenses and lenticles of chromite. Further, it is sparsely distributed in the veinlets of serpentine that traverse the ore. It is red or purple in colour, and has a distinct flaky habit occurring mostly as small thin spangles, sometimes along with biotite.

Under the microscope, the mineral appears in the form of thin flakes, deeply coloured owing to high dispersion, the phenomenon resembling the twinkling in calcite. It is seen close to masses of serpentine and has opaque or nearly opaque chromite moulded on it. A few flakes show bent cleavages also. Its microscopic characters as determined with Federov's Universal Stage are as follows:

Optically negative; biaxial with very low optic axial angle (2V) ranging from  $15^\circ$  to  $2.5^\circ \pm 0.5^\circ$ , tending to be almost uniaxial; pleochroism X: Pale red purple; Y = Z: Pale reddish yellow; X direction normal to (001); birefringence (as measured with Berek's Compensator) 0.004.

Winchell<sup>1,2</sup> is of the opinion that when chromium enters chlorite in any significant amount, it imparts a violet or lavender colour to the mineral which assumes an optically negative character. However, he mentions also an optically positive variety from Sweden. Similar variation in optical character has also been referred to by Dana.<sup>3</sup> The mode of occurrence and characteristic association of the mineral with chromite and serpentine of Shetland Islands has been outlined by Phillips<sup>4</sup> and similar association with chrome ore has been reported by others at various points in North Carolina. In India the mineral has so far been reported only from Mysore by Naidu<sup>5</sup> and by Viswanathiah.<sup>6</sup>

The present occurrence of k  mmererite in association with serpentine and chrome ore is significant in that it speaks of the activity of hydrothermal solutions in the formation of the species of chlorite under consideration as also of some chromite, a conclusion reached earlier

1. Rao, V. R., *Curr. Sci.*, 1950, 19, 8. 2. Slater, J. C., *Phys. Rev.*, 1929, 34, 1293. 3. Racah, G., *Ibid.*, 1942, 62, 438. 4. Condon, E. U. and Shortley, G. H., *Ibid.*, 1931, 37, 1025. 5. Racah, G., *Ibid.*, 1949, 76, 1352.

by the author<sup>7</sup> with regard to the genesis of the ore of the area.

Further work on the material is in progress and a detailed paper will be published elsewhere.

Dept. of Geology,  
Andhra University,  
Waltair,  
February 4, 1952.

M. SRIRAMA RAO.

1. *Amer. Mineral.*, 1936, **21**, 642. 2. *Elements of Optical Mineralogy*, Part II, 3rd Edition, John Wiley & Sons, 1946, 286. 3. *Text-Book of Mineralogy*, 4th Edition, John Wiley & Sons, 1947, 670. 4. *Quart. Jour. Geol. Soc. Lond.*, 1927, **83**, 622. 5. *Proc. 33rd Ind. Sci. Cong. Abstracts*, 1943, **39**. 6. *Curr. Sci.*, 1951, **20**, 15. 7. *Proc. Ind. Acad. Sci.*, 1947, **26**, 133.

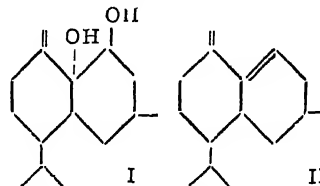
### SESQUITERPENES FROM *PIPER CUBEBA*, LINN.

THE sesquiterpene hydrocarbon fraction ( $C_{15}H_{24}$ ), b.p. 111–112°/9 mm.  $d_4^{25}$  0.8894,  $n_D^{25}$  1.4859,  $n_D - 25.78^\circ$  M.R. 65.95, unsaturation value 1.45, isolated from the essential oil from *Piper cubeba*, Linn., is not cadinene, as reported by Simonsen<sup>1</sup> and co-workers, but a mixture of the tricyclic hydrocarbon copæne (responsible for the formation of cadinene dihydrochloride) with another new hydrocarbon possessing two conjugated double bonds, as indicated by (i) reduction with sodium and alcohol, (ii) adduct with maleic anhydride (M.P. 125–127° C.), and (iii) red colour with diazotised p-nitroaniline (Fieser's test).<sup>2</sup>

Ozonolysis, along with other products, gives formaldehyde, formic acid and copæne carboxylic acid<sup>3</sup> (semicarbarone, m.p. 222°). The presence of copæne has been confirmed by the labelling method of Ruzicka and Sternbach<sup>4,5</sup> and isolation of 7-methyl cadalene. As copæne does not contain any exocyclic double bond, the formaldehyde formed during ozonolysis must be coming from the new conjugated hydrocarbon. The latter, therefore, must possess an exocyclic double bond.

Like other conjugated compounds,<sup>6–10</sup> this new hydrocarbon forms a normal oxide with percamphoric acid, but with perbezoic acid it forms a hydroxy-monobenzoate, which on alkaline hydrolysis produces a  $\alpha$ -glycol. The glycol gives cadalene on dehydration and formaldehyde on ozonolysis. Specific oxidation test with lead tetra-acetate and potassium periodate<sup>11,12</sup> shows that at least

one of the hydroxyl groups is secondary. The glycol undergoes almost spontaneous dehydration in a slightly acidic medium giving rise to a hydrocarbon. Taking all these facts into consideration, the most likely formula for the glycol is (I) and that for the hydrocarbon is II.



The authors are thankful to Prof. P. C. Guha and Dr. Sukhdev for their kind interest during the course of this investigation.

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1. Rao, Shintre and Simonsen, *J. Soc. Chem. Ind.*, 1928, 47, 92–47. 2. Fieser and Campbell, *J. Amer. Chem. Soc.*, 1938, **60**, 168. 3. Semmler and Stenzel, *Ber.*, 1914, **47B**, 2557. 4. Ruzicka and Sternbach, *Helv. Chim. Acta.*, 1940, **23**, 124. 5. Briggs and Taylor, *J. Chem. Soc.*, 1947, 1338. 6. Windaus and Lultringhaus, *Ann.*, 1930, **481**, 119. 7. Fieser and Fieser, *Natural Products Related to Phenanthrene*, 1949, 3rd edition, p. 225–27. 8. Bengmann and Skan, *J. Org. Chem.*, 1950, **5**, 439–42. 9. Bradshos, *J. Amer. Chem. Soc.*, 1944, **66**, 45–46. 10. Newbold and Spring, *J.C.S.*, 1945, 247. 11. Criege, *Ber.*, 1931, **64**, 260. 12. Schriener and Fuson, *The Systematic Identification of Organic Compounds*, 3rd edition, p. 115.

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### FATTY OIL FROM THE SEEDS OF *OCIMUM SANCTUM* LINN. (TULSI)

On extraction with ether, the crushed seeds, obtained from plants grown on the premises, yielded a greenish yellow fatty oil 17.82%. It has the following properties: Specific Gravity (30° C.), 0.9063;  $N_D^{20}$  1.4789; Acid Value, 2.02; Saponification Value, 181.65; Iodine Value, 173.0; Thiocyanogen Value, 104.6; Acetyl Value, 12.11; R.M. Value, 1.2; Polenske Value, 0.2; Hehner Value, 93.56; Unsaponifiable Matter, 2.32.



The composition of the fatty acid is as follows: Palmitic, 6.9%; Stearic, 2.1%; Linolenic, 15.7%; Linoleic, 66.1%; Oleic, 9.0%. The unsaponifiable matter yielded a small quantity of sitosterol.

On direct bromination of the oil in dry ether, insoluble bromoglycerides were crystallised out. Three bromoglycerides were isolated—two dilinolenolins melting at 157° C. and 145° C. respectively and a linolenodilinolin melting at 80° C. The *Ocimum sanctum* seed oil showed good drying properties. A few drops of the oil spread into a thin film on a glass plate dried within 4 days into a tough film.

Details will be published elsewhere.

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Willingdon College, V. A. PATWARDHAN.  
Sangli,  
January 17, 1952.

#### AN ANTIDIABETIC PRINCIPLE FROM *RIVEA CUNEATA* (WRIGHT)

CLINICAL trials showed that oral administration of a milk extract of the leaves of *Rivea cuneata* for 3-5 days brings about a significant remission of the characteristic symptoms of diabetes. It was, therefore, of interest to investigate the antibiotic principle associated with the leaf.

Extraction of the leaves of *Rivea cuneata* with alcohol yield a concentrate containing an active principle which has a significant effect on alloxan diabetes in rats. The active principle has been identified as a glycoside. It is soluble in water and alcohol, but insoluble in other organic solvents. On acid hydrolysis, it yields a reducing sugar glucose, and a water soluble aglucone, which gives the colour reaction characteristic of steroids.

Pharmacological experiments in dogs show that the glycosides given in large doses, 3 g/kg. body weight lowers the blood pressure. Toxicity tests on mice showed that it is non-toxic even in large doses, 1.0 g/kg. body weight.

The glycoside when administered orally has little effect on fasting blood sugar level in man, rabbit and rats. When given subcutaneously, the glycoside has no effect on the blood sugar level in rabbits.

The effect of the glycoside on experimental alloxan diabetes in albino rats was very encouraging. The glycoside was given orally to rats in daily doses of 5 mg. dissolved in water; after 8 days, they received subcutaneous injections of 200 mg./kg. of alloxan. At the end of 4 days, all the rats in the treated group had

normal blood sugar and no sugar in urine. Mortality was 20 per cent. as compared with 60 per cent. in the control group. Further observations showed that treated rats had relapses after 30-40 days. A second course of treatment was beneficial only in 10 per cent. of these rats.

Post-mortem examination of pancreas in normal rats receiving the glycoside orally for 30 days and killed 30 days after treatment, showed evidence of hyperplasia and hypertrophy of the islets of Langerhans. Other organs appeared normal.

Our grateful thanks are due to the Indian Council of Medical Research for the grant of a Fellowship to one of us (M. R. R. R.) and to the Director of the Indian Institute of Science, Bangalore, and the Director of the Central Drug Research Institute, Lucknow, for their keen interest. Our thanks are also due to Dr. K. P. Menon for his kind interest in the work.

Central Drug M. R. RAJA RAMA RAO.  
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Lucknow.

1. Hooker, *Flora of British India* London., 1897, 4, 191

#### CONTROL OF FUNGAL GROWTH BY EARTHWORMS

ONE of the difficulties experienced in the course of breeding *T. deliensis* (Walch) in the laboratory by several workers<sup>1,2,3</sup> is the growth of fungal mycelia in the rearing tubes. Attempts to control fungal growth through the use of copper sulphate solution<sup>2</sup> or by the addition of lime<sup>1</sup> to the breeding tubes have met with only partial success. In the course of this work, it was observed that in one of the breeding tubes that had been prepared with a fresh batch of Hooghly river sand, there were a few small earthworms and in this tube alone, there was no fungus growth and the breeding of mites was satisfactory. We have since fully convinced ourselves that these earthworms are mainly responsible for keeping down fungal growth.

Although originally the earthworms came from the river sand, search of the garden soil in the Institute revealed that similar earthworms were present there also. These worms are translucent white in colour and seldom exceed 2" in length, when fully grown. They have been identified as a species of *Enchytræus* (Fam. Enchytræidae: Oligochæta). They breed freely in the mite-rearing tubes and when their number becomes excessive, the surplus is transferred

to 'stock-pots' leaving only a few in the rearing tubes. The stock-pots are ordinary tubes with about an inch of moist sand at the bottom; mosquito eggs, decaying leaves, rotting filter-paper and other similar substances are put in, to provide food for the worms. Transferring the worms from the stockpot to the rearing tubes or vice versa is not difficult, as they always show a tendency to collect around a clump of mosquito eggs or a piece of filter-paper. This clump of eggs with the worms round it, can then be picked up easily and transferred to any breeding tube as required.

The authors wish to thank Dr. K. V. Krishnan, for facilities provided for this work, and to Dr. K. N. Bahl, for kindly identifying the earthworms.

All-India Inst. of R. O. A. SMITH.  
Hyg. & Pub. Health, M. G. RAJA VARMA.  
Calcutta, K. P. BHATTACHARYA.  
February 22, 1952.

1. Cockings, K. L., *Bul. ent. Res.*, 1948, 39, 281. 2. Krishnan, K. V., *et al.*, *Ind. Med. Gaz.*, 1949, 84, No. 2, 39. 3. Radford, C. D., *Parasit.*, 1946, 37 (1 2), 42.

#### CHROMOSOME NUMBER IN SOME MEMBERS OF APOCYNACEAE AND LYTHRACEAE

THE chromosome numbers of the following species have been determined and as far as the authors are aware they have not been reported by any workers previously.

LYTHRACEAE	<i>n</i>	<i>2n</i>
<i>Lagerstrœmia indica</i>	.. 24	
<i>Lagerstrœmia Flos-Reginæ</i>	.. 24	
<i>Lagerstrœmia Thorelli</i>	.. 24	
<i>Woodfordia floribunda</i>	.. 8	
APOCYNACEAE		
<i>Allamanda grandiflora</i>	.. 9	18
<i>Allamanda violacea</i>	.. 18	36
<i>Tabernaemontana dichotoma</i>	.. 11	22
<i>Tabernaemontana coronaria</i>		33

Bhupendra Singh<sup>1</sup> has reported the chromosome numbers of three species of *Plumaria*, viz., *P. alba*, *P. rubra* and *P. acutifolia*. Of these he has reported the somatic and gametic numbers of the first and the gametic numbers only of the remaining two species. Our investigations of the same three species of *Plumaria* confirm the *n* and *2n* determinations of Bhupendra Singh. Further the *2n* number, 36 of *P. rubra*

and *P. acutifolia* determined by us accords with *n* = 18 previously determined by Bhupendra Singh.

In the genera *Allamanda* and *Tabernaemontana* polyploidy is observed with *A. grandiflora* representing a diploid and *A. violacea* a tetraploid. *T. dichotoma* has a diploid number of 22 compared to the triploid number of 33 of *T. coronaria* reported above. Phatak and Tiwari<sup>2</sup> report of a diploid type of *T. coronaria* with *2n* = 22, which with the number reported above shows the existence of polyploidy within this species.

In the above species of *Allamanda* and *Tabernaemontana* examined, multivalent association of chromosomes were frequently observed.

The counts of somatic and gametic numbers were made from permanent mounts of paraffin embedded material.

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College of Agriculture, J. A. VASAVADA.  
Poona 5, S. P. BHAGAT.  
October 27, 1951.

1. Bhupendra Singh, *Curr. Sci.*, 1951, 20 (4), 105. 2. Phatak, G. W., *et al.*, *Curr. Sci.*, 1949, 18, (9), 347.

#### ACTINOMYCETES ANTIBIOTIC TO PLANT-PATHOGENIC BACTERIA

DURING the course of a study of some actinomycetes isolated from Karnatak soils it was thought worthwhile to determine whether any of the cultures under study were antibiotic to plant-pathogenic bacteria that occur in India. In all, 64 cultures of actinomycetes (as yet not identified) were tested against 20 species of plant-pathogenic bacteria belonging to the genus *Xanthomonas*. Members of this genus are Gram negative rods, motile by a single polar flagellum, and produce a yellow pigment.

The tests for antibiosis were carried out on a modified Czapek's medium containing peptone, using a standard technique; this medium was selected; from amongst a large number tried, as it supported good growth of both the test organisms and the bacteria. Inoculations were made with a straight needle from cultures on Czapek's agar slants. Incubation was done at 30° C.

The results were recorded after 48 hours' incubation in most cases by measuring the zones of inhibition around colonies of the test organisms. However, some of the plant-pathogenic bacteria grew slowly and in such cases results

were taken when the bacteria had fully grown and covered the plates.

Of the 20 species of *Xanthomonas* tested, *X. cassiae* and *X. begoniae* were not inhibited by any of the actinomycetes, whereas the rest of the species were inhibited by one or more cultures of the actinomycetes.

From the 64 cultures of actinomycetes under study, only 7 proved antibiotic to 3 or more species of the bacteria tested. The results obtained with these 7 cultures are recorded in the accompanying Table.

Species of <i>Xanthomonas</i>	Zone of inhibition (dia. in mm.) produced by actinomycetes: Culture Nos.						
	5	20	23	33	39	45	48
<i>X. campestris</i>	..	..	30	15	C	C	C
<i>X. citri</i>	..	..	..	..	..	..	7
<i>X. malvacearum</i>	..	C	20	..	C	C	25
<i>X. sojense</i>	..	..	25	..	..	..	7
<i>X. desmodii</i>	..	..	..	10	..	..	7
<i>X. desmodii-gangetica</i>	..	17	25	17	17	10	15
<i>X. vignicola</i>	..	..	45	17	12	30	..
<i>X. uppalii</i>	..	20	15	12	10	10	..
<i>X. vesicatoria</i>	..	55	40	35	30	..	30
<i>X. alfalfae</i>	..	12	..	..	..	15	12
<i>X. badri</i>	..	20	..	..	..	..	..
<i>P. bellicola</i>	..	20	..	..	..	..	..
<i>X. cassiae</i>	..	..	..	..	..	..	..
<i>X. ricinicola</i>	..	25	15	..	25	15	20
<i>X. begoniae</i>	..	..	..	..	..	..	..
<i>X. stilosobicola</i>	..	30	..	..	..	..	..
<i>X. larsoniae</i>	..	20	..	..	..	..	..
<i>X. tamarindi</i>	..	30	..	..	..	..	..
<i>X. poinsettiae</i>	..	5	..	..	..	..	10
<i>X. cajani</i>	..	30	..	..	15	..	10

Note.—C=complete inhibition: zone too large to be measured.

Further work using filtrates of the promising actinomycetes cultures on Czapek's medium is in progress. In similar experiments with plant-pathogenic fungi of the soil, some of the cultures have given promising results against *Sclerotium rolfsii*. The morphological and biochemical characters of the actinomycetes are also being studied with a view to ascertaining their identity.

The authors are grateful to the Plant Pathologist to Government, B.S., Poona, for supplying cultures of *Xanthomonas* species.

Bacteriology Section, V. P. BEIDE.  
College of Agriculture, L. MONIZ.  
Dharwar, R. B. PATIL.  
November 8, 1951.

## BLOSSOM BLIGHT OF DAHLIA

THE blight of Dahlia flowers was observed at Nagpur, during the period of high humidity in the atmosphere in August and September, 1950.

The disease starts as a minute water-soaked spot on the succulent corolla. These spots soon enlarge causing a soft-rot and shedding of a majority of petals. The affected tissues are discoloured brown to black. The infection may also advance to the sepals and the floral stalk. Soon after, a luxuriant crop of silvery white conidiophores and deep brown to black heads of conidia and sporangia appear on the affected tissues of the blossom. The mycelium of the organism is found traversing the tissues of the affected parts.

The organism produces a luxuriant cottony aerial growth of aseptate mycelium and grows rapidly at a room temperature (28-30° C.) on rice meal-agar.

The conidia and conidiophores are produced on the host as well as in the culture. On the host the conidiophores are erect, continuous and unbranched. They are white at first and metallic silvery when ripe. The conidiophores end in a capitate vesicle from which numerous short-stalked globular to pyriform cells arise. These cells produce a number of short sterigmata each of which bears a single conidium at the apex. After the release of the conidia the globular or pyriform cells collapse resulting in the funnel-shaped structures still attached to the primary capitate vesicle.

The conidia are single-celled, dark-brown in colour, globular or elliptical or obovate in shape with a distinct scar at the point of attachment. They are finely spinulose and measure  $7.5-23.7 \times 6.7-14.4 \mu$  (average  $15.1 \times 10.7 \mu$ ).

The sporangia are produced both on the host and in the cultures. They have a thin wall which soon ruptures to liberate the brown sporangiospores leaving a large round columella and the remnants of the sporangial wall. The sporangia produced on the host are  $27 \mu$  in diameter while those produced in the culture vary from  $30.0-48.0 \times 30.0-60.0 \mu$  (average  $39.1 \times 43.3 \mu$ ).

The sporangiospores are globose, elliptical or triangular in shape, dark-brown in colour and measure  $7.3-18.6 \times 4.4-13.6 \mu$  (average  $13.8 \times 9.3 \mu$ ), more or less equal to the conidia in size.

The zygospores produced in cultures, are dark-brown to chocolate in colour, almost globular in shape with a thick smooth epispore. They are  $36.6-60.9 \mu$  (average  $50.1 \mu$ ) in diameter.

The morphology and the cultural characters of the fungus correspond to those of *Choanephora infundibulifera* (Currey) Cunningham. Burger (1924) reported from Florida, a similar disease of *Dahlia* caused by an unidentified species of *Choanephora*.

When the spore-suspension of the organism was sprayed on fresh *Dahlia* flowers the infection was observed within 24 hours and the typical blight appeared. The pathogen was reisolated. The flowers in controlled series remained all healthy.

Thanks are due to Dr. R. P. Asthana, Mycologist to Government, Madhya Pradesh, for facilities accorded for the work.

Agri. Research Institute, ABIR CHANDRA JAIN.  
Nagpur, K. G. NEMA.  
January 9, 1952.

1. Burger, O. F., *Rept. Plant Pathologist—Rept. Floard Agric. Exp. Stat.*, for the fiscal year ending June 30, 1924, 84 R—113 R, 1924.

# AN EXCEPTIONAL GYNÆCEUM OF *CITRUS MEDICA* VAR. *LIMON* L. SHOWING ADHERENT POLLEN CHAMBERS AND EXTRA-OVARIAN OVULES

WHILE dissecting out a flower of *Citrus medica* var. *limon* it was found that the gynæceum was peculiar in having some anther lobes adhering to the ovary and style. Another interesting feature revealed by microscopic study was the presence of ovules on the outer surface of the ovary wall.

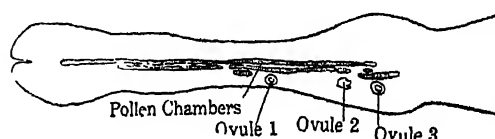
The gynæceum, which was about 9 mm. long and 1.4 mm. wide, was fixed and sectioned transversely for detailed study.

The ovary was elliptical at its base with certain insignificant undulations and contained prominent oil glands in its peripheral region. The ovary was 8-locular, with axile placentation and two rows of ovules in each locule.

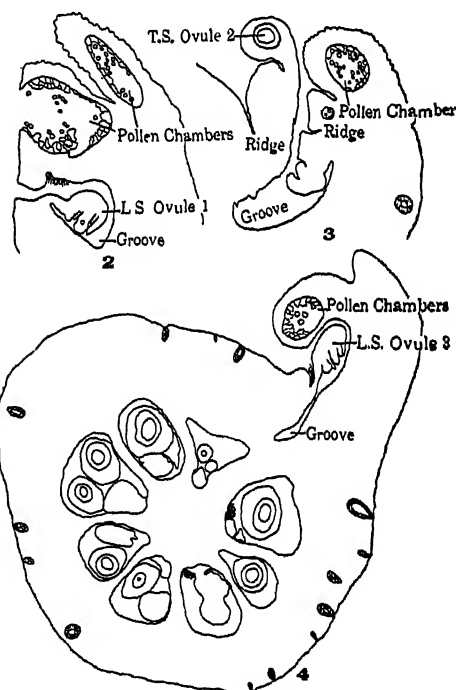
A study of serial transverse sections showed that the gynæceum had a groove running along its entire length, the groove itself being accompanied by a longitudinal ridge on each side. The edges of the two ridges were curved towards each other so that the groove appeared like a canal. The edges of the ridges, however, remained sufficiently apart to leave a long slit-like opening along the entire length except when approaching the stigma. Here the ridges fused producing a closed chamber which looked like

the continuation of the ovarian chambers seen in that region.

Along one of the ridges 7 pollen chambers were present, of which one ran longitudinally almost from the base of the ovary to the stigma. Four, situated one above the other, formed a second line parallel to the first and the remaining two lay adjacent to the second line, one near the bottom, the other near the middle (Fig. 1).



The pollen chambers were in different stages of development, some showing intact tapetum



FIGS. 1-4. *Citrus medica* var. *limon* L. Fig. 1. Reconstruction of the gynæceum from T. sections showing adherent pollen chambers and extra-ovarian ovules  $\times 25$ . Fig. 2. T. S. gynæceum showing the groove, the extra-ovarian ovule 1 and dehiscence P. chamber.  $\times 60$ . Fig. 3. T. S. gynæceum through extra-ovarian ovule 2.  $\times 60$ . Fig. 4. T. S. entire ovary showing extra-ovarian ovule 3.  $\times 50$ .

and tetrads enclosed within the wall of the pollen mother-cell, others with fully developed

pollen grains and tapetum disorganised. One chamber had dehisced, but all the pollen grains had not escaped from the pollen chamber (Fig. 2). The pollen grains examined had one nucleus and three germ pores.

The other ridge bore three ovules situated one above the other and the latter showed an early stage of development. The lowest ovule, seen in longitudinal section, was directed towards the depression in the ovary wall (Fig. 4). The second one, seen in transverse section, was directed outwards and was quite exposed (Fig. 3). The uppermost ovule was borne on the ridge in the stylar region and seen in longitudinal section (Fig. 2). These ovules were bitegmic. Stages in the development of the embryosac could not be studied due to degeneration. The extra-ovarian ovules did not differ structurally from those present in their normal position.

Although adhesion of anthers to gynæceum is a regular feature in certain plants, the present case is to be regarded as a teratological phenomenon because it is not usually found in plants of the family Rutaceæ. A somewhat similar case has recently been reported in *Zephyranthes roseum* Lindl. (Amaryllidaceæ).

The presence of naked ovules outside the ovary is specially noteworthy (Fig. 3). It might be explained by supposing that a chamber had been displaced outwards and its outer wall did not develop properly.

I am grateful to Mr. Reayat Khan, who gave me the material and helped me in writing the account.

Department of Botany, MOHD. FAROOQ.  
Muslim University,  
Aligarh,  
November 11, 1951.

1. Abraham, P., *J. Indian Bot. Soc.*, 1934, 14, 291.
2. Bambacioni-Mazzetti, V., *Ann. Bot.*, (Roma), 1937, 21, 1.
3. Baranov, P., *Ber. Deutsch. Bot. Ges.*, 45, 97.
4. Fotidar, A. N., *J. Indian Bot. Soc.*, 1939, 18, 59.
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6. Raunkiaer, C., *Sv. Bot. Tidskr.*, 1914, 33, 379.

# **PINNASPIS SP.—NEW COCCID PEST ON CORCHORUS CAPSULARIS LINN. (JUTE)**

FERRIS AND RAO<sup>1</sup> have revised the genus *Pinnaspis*, previously described under different names since 1892 and in their opinion, its centre of origin lies in India and Ceylon. Further information is, therefore, likely to be obtainable

only from this region and a species of *Pinnaspis* recorded on *Corchorus capsularis* Linn. furnishes information hitherto unrecorded.

The pest was collected and multiplied under laboratory conditions for further observation. The young nymphs after hatching move about for about 30-40 hours to fix themselves for the rest of their lives to the host plant and draw their nourishment therefrom. During the first instar, curly waxy fibres are secreted by both male and female nymphs; morphological differentiation of sex begins on the 4th or 5th day with the development of scales; males developing white tricarinate scales, and females secreting elliptical brown scales with broadened ends. Females are apterous throughout their lives and cannot move, once they are fixed. Delicate two-winged males emerge out from the carinated scales.



FIG. 1. Photomicrograph of *Pinnaspis* sp., female × 55.

Derm of the adult female (Fig. 1) is membranous with a weakly developed sclerotinised pygidium. Two or three notched median pygidial lobes are closely united at the base by a median sclerosis with their distal mesial margins fused or very slightly separated. Anal orifice is situated near or slightly anterior to the centre of pygidium. Preanal scars are distinct and are crescentic in shape. Perivulvar pores are arranged in five groups around the anal orifice. Two-barred ducts and gland spines are prominent. These are some of the important characters which place the present material near the species *strachani* under genus *Pinnaspis*.

The presence of a short parallel-sided mesial lobule of the second pygidial lobe suggests that the present species is nearer to the *townsendi* type of *P. strachani* than to the typical

*strachani* of Cooley. But the presence of a greater number of minute ducts (3-10) in each cluster of the submedian series places it nearer to the typical *strachani* than to the *townsendi* type, where each cluster contains 2-3 ducts, which are large as submarginal macroducts.

The present material again differs from both the other types in the arrangement of macroducts in the 3rd-5th abdominal segments (Table I).

TABLE I

Type	SEGMENT		
	3rd	4th	5th
<i>P. strachani</i>	.. 3-5	3-5	1-3
<i>Pinnaspis</i> sp. (present material)	.. 5-21	5-15	6-16

Two other important fibre crops, viz., *Hibiscus sabdariffa* var. *altissima* Hort. and *H. cannabinus* Linn. have been recorded as alternate hosts, though *Corchorus olitorius* Linn. (sweet jute) has been found to be resistant to this species.

Thanks are due to Dr. W. J. Hall, Director, Commonwealth Institute of Entomology, London, for kindly identifying the material as *Pinnaspis* sp. near *strachani* Cooley and also to Dr. B. C. Kundu, Director, Jute Agricultural Research Institute, for his keen interest in the work.

Jute Agri. Res. Institute, N. DUTT.  
Barrackpore,  
W. Bengal,  
January 9, 1952.

1. Ferris, G. F. and Rao, V. P., "The genus *Pinnaspis* Cockerell (Homoptera, Coccidae, Diaspididae)," *Microentomology*, 1947, 12, Part 2, 25-58.

## TWO NEW BACTERIAL DISEASES OF PLANTS

A BACTERIAL leaf-spot on *Clerodendron phlomoidis*, a tall pubescent shrub growing by the side of railway lines was noticed for the first time at Kirkee in 1949. The shrub is common in many parts of India, principally in the drier regions of the Punjab, the Deccan, Bihar, Oudh, Madhya Pradesh, Gujarat and also Ceylon. Besides its use as a bitter tonic, its leaves are relished by cattle, especially the goat.

On the leaves, the pathogen produces round to irregular water-soaked spots on the lower surface. In advanced stages of infection, the spots become irregular in shape and often coalesce forming large angular lesions measuring 4 mm. The corresponding areas on the upper surface become brown to dark brown. Often, the spots have a thin parched centre and cause slight leaf crinkling. Bacterial ooze in the form of small, pearly beads appear on the lower surface of the leaves. The pathogen infects veins and the leaf edges.

*Description of the Pathogen.*—Short rods; single or in chains;  $1.1 \times 0.5 \mu$ ; gram negative; capsulated; no spores; on potato dextrose agar, the colonies are circular with entire margins, measuring 1.8 cm. in diameter after 7 days; colour pale lemon yellow (R); gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; ammonia and hydrogen sulphide produced; nitrates not reduced; acid but no gas from dextrose, sucrose and lactose; no growth in salicin; optimum temperature for growth about  $31^\circ\text{C}$ ; thermal death point near  $51^\circ\text{C}$ ; pathogenic on *Clerodendron phlomoidis* L.

Since the organism is new to science, it is proposed to name it *Xanthomonas clerodendroni* nov. sp.

(2) On the Agricultural College Farm, Poona, in 1949, a new bacterial disease was noticed on *Sesbania aegyptiaca*, a shrub used as fodder, windbreak and supports in betel leaf and grape gardens.

On the leaves, the disease appears as small, round, water-soaked spots 0.5 to 1 mm. surrounded by halo measuring about 1.5 to 2 mm. in diameter. On the upper surface of the leaves, the corresponding areas become chlorotic. The centre of the spot turns brown whereas the surrounding area turns yellow. As a result of severe infection, the entire leaflet becomes chlorotic and ultimately sheds. Infection of the tender stem is found in the form of vertical greyish streaks measuring about 4 mm. in length. On the rachis of the leaf, infection takes place in the form of long vertical greyish lesions upto 3 mm. in length. The centre of such lesions often cracks oozing minute, pearly, bacterial gummy beads. The pathogen infects leaf edges also.

*Description of the Pathogen.*—Small rods; single or in chains;  $1.3 \times 0.7 \mu$ ; gram negative; capsulated; no spores; on potato dextrose agar, the colonies are circular with striations starting 5 mm. away from the centre, and coming

upto the periphery; colour barium yellow (R); diameter 2 cm. in 7 days; gelatin liquefied; starch hydrolysed; casein digested; milk slightly peptonised; litmus slowly reduced; ammonia and hydrogen sulphide produced; nitrates not reduced; acid but no gas from dextrose, sucrose and lactose; no growth in salicin; optimum temperature for growth 31° C.; thermal death point about 51° C., pathogenic on *Sesbania aegyptiaca* Poir.

Since no bacterial disease has been reported on *Sesbania aegyptiaca*, it is proposed to name it *Xanthomonas sesbaniae* nov. sp.

Fuller details will be published elsewhere.

Plant Pathological Lab., M. K. PATEL.  
College of Agriculture, Y. S. KULKARNI.  
Poona, G. W. DHANDE.  
January 15, 1952.

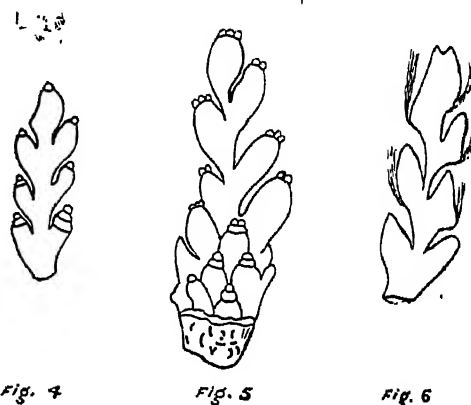
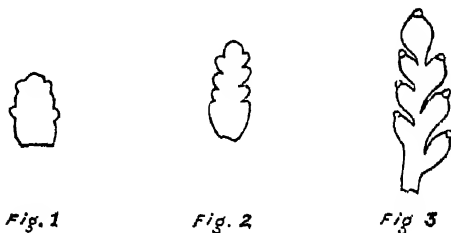
#### NODAL BUDS OF NARENGA PORPHYROCOMA (HANCE) BOR.

THE genus *Narenga* Bor. consisting of a single known species *N. porphyrocoma* (Hance) Bor. was formerly under the genus *Saccharum* L. as *S. narenga* Wall. but has recently been given generic rank. Unlike in the species of *Saccharum*, only flowering culms are noticed in *N. porphyrocoma* and the nodes have buds but no root eyes.

In one of the experiments at the Physiology Section, a short axillary panicle of about two inches was found to have developed at the top node of a flowered culm of *N. porphyrocoma*. This unnatural development attracted attention and led to the examination of the lower buds as also those in a number of flowering culms. It was noticed that the buds at the nodes were floral and not vegetative as was supposed to be. This was a characteristic of the species.

The flowering culm usually has five nodes of which the top most, next to the rachis, is devoid of bud. In culms of the same age, the development of the floral buds followed a regular and successive stage of development from bottom to top. In a culm wherein the panicle is in full bloom and anthesis in progress, the dissection of the bottom bud reveals a long thin meristem with two ranks of lateral ridges (Fig. 1). In the next upper node, the two rows of alternating ridges are more pronounced, each ridge embracing more than half the circumference (Fig. 2), while in the third and fourth nodes, the buds show differentiation into rudimentary spikelets (Figs. 3 & 4). In more advanced culms,

wherein the anthesis is over and the spikelets start drying up, the bud at the bottom node shows directly the stage in Fig. 3 and the other



three buds higher up, the stages as in Figs. 4, 5 & 6. The last-mentioned is an advanced stage with differentiation of glumes and callus hairs.

This is the first report of the occurrence of floral buds at the nodes in the tribe *Andropogoneae* and indicates a close relationship between the two tribes *Andropogoneae* and *Majdeae* with *N. porphyrocoma* forming a connecting link between the two tribes.

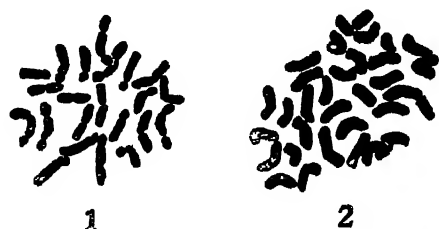
Sugarcane Breeding Inst., M. VIJAYASARADHY.  
Coimbatore, J. THULJARAM RAO.  
January 18, 1952. R. NARASIMHAN.

#### AUTOTRIPLOIDY IN GUAVA (*PSIDIUM* *GUAJAVA*, LINN.)

AMONG the seeded varieties of guava 'Lucknow 49' has a somatic complement of 22 chromosomes (Fig. 1). The meiotic behaviour of its chromosomes is regular. Janaki Ammal<sup>2</sup> and Atchison<sup>1</sup> have reported the chromosome number of guava as  $2n=22$ , which tallies with the chromosome number of the seeded variety 'Lucknow 49'.

A seedless variety<sup>3</sup> from a collection examined by us has a somatic complement of 33 chromosomes as determined from the vegetative tissue of its anthers (Fig. 2) It

shows a highly abnormal meiotic behaviour such as formation and non-disjunction of multivalents, lagging of chromosomes, unequal distribution of chromosomes to the two poles during



FIGS. 1 and 2. Somatic Chromosomes of the seeded variety "Lucknow 49" ( $2n = 22$ ) and the "Seedless" variety ( $3n = 33$ ) respectively  $\times 4000$  approx.

first anaphase, formation of micronuclei, etc. 77 per cent. of chromosomes associate to form trivalents during the first division. This high percentage of trivalent formation, and the somatic chromosome number of  $2n = 33$ , clearly show the autotriploid nature of the variety, which obviously is responsible for the absence of seeds.

The above appears to be the first record of triploidy in guava. The presence of a triploid as reported here shows the existence of polyploidy in guava.

Cytogenetical Laboratory, L. S. S. KUMAR.  
College of Agriculture, S. G. RANADE.  
Poona 5,  
February 2, 1952.

\* A collection of Indian varieties of guava (*Psidium guajava* Linn.) is maintained at the Ganeshkhind Fruit Experimental and Research Station, Kirkee, and in the Modi Bagh of the College of Agriculture, Poona.

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#### OCURRENCE AND INHERITANCE OF 'FILICOID' FORM IN *CICER ARIETINUM* L.

BENGAL GRAM, *Cicer arietinum* L., is found to be much susceptible to mutations and one frequently comes across abnormalities in normal crops or in hybrid generations.<sup>1,2</sup> The following is a report of one such instance.

In the  $F_3$  progeny of a cross between *Cicer arietinum* L. var. *alternifolia*—a mutant breeding true for its alternate leaflet arrangement—and a normal leaved gram plant grown in 1948, eight fern-like plants with very small leaflets were traced. As they were very different in aspect of branching, leaf and leaflet arrangement from either the  $F_1$  or the  $F_2$  progeny which segregated into 31 normal-leaved plants, which the leaflets are mostly placed opposite

each other in pairs: 8 *alternifolia*, it was suspected that the new plants appeared as a result of mutation. These came from the  $F_2$  plant No. 20 which had the alternate leaflet arrangement. The  $F_3$  progeny consisting of 37 plants segregated into 29 *alternifolia* and 8 *filicoid* or fern-like but sterile plants. This agrees with the 3:1 ratio in spite of the small number of plants.

**Description of the Filicoid Variety.**—The fern-like segregate mentioned above was found to have unusually small, narrow leaflets measuring 5 mm.  $\times$  1.5 mm. as compared to those of the normal ones measuring 7 mm.  $\times$  4 mm. The plants had profuse lateral branches with extremely short internodes. The large number of branches crowding all around the main stem gave the plants a cylindrical appearance, there being almost no secondary branches. All the leaves on a branch were almost uniform in length. The leaflets were oblique and densely placed on the mid-rib, their arrangement being irregular and alternate. Rudimentary floral buds were borne in the axil of every leaf. The perianth had a globular appearance and the anthers were devoid of pollen. The keel petal was altogether missing. All the eight plants noticed in 1948 were found to be entirely sterile. For the sake of convenience of identification this mutant type has been named by the author as *Cicer arietinum* L. var. *filicoid*.

**The  $F_4$  Generation.**—Out of the 29 fertile alternate-leaved plants obtained in the  $F_2$  generation, seeds of 21 plants were sown to raise the fourth generation of the cross in 1949 which gave the following type of plants:

- (1) Progenies of 8 families consisted entirely of fertile plants.
- (2) Progenies of 13 families gave 425 fertile *alternifolia*s 141 *filicoid*—an extremely good fit on the basis of an expected monohybrid ratio 424.5 *alternifolia*: 141.5 *filicoid*.

In the  $F_4$  generation too some of the progenies continued to segregate into *alternifolia* and *filicoid* plants in the proportion of 3:1.

The sterile nature of the mutant plants leads one to suspect that the mutation reported above may be a case of chromosomal abnormality.

Cytological examination is now being undertaken to verify this point.

Agricultural Officer, G. P. ARGIKAR.  
Rice Breeding Station,  
Bulsar,  
Bombay State,  
January 31, 1952.

1. Argikar, G. P., Unpublished. 2. Bhat, N. R. and Argikar G. P. *Heredity* April 1951 **5** Part 1 142-48



# CYTOLOGY OF *ADHATODA VASICA* NEES

THE genus *Adhatoda* is represented in India by two species,<sup>1</sup> of which *A. vasica* is common throughout the country and forms a characteristic feature of the vegetation of Delhi Ridge. It has important medicinal properties. The only previous record on the cytology of the genus is a report of the haploid chromosome number ( $n=17$ ) by Pathak, et al.<sup>2</sup> Additional details are given below.

Meiotic behaviour has been studied from smears fixed in Belling's modification of Navashin's fluid and stained with crystal violet. Somatic chromosomes have been examined from root-tips fixed by the oxy-quinoline method of Tijs and Levan as modified by Sharma and Ghosh.<sup>3</sup>

Meiotic division of the pollen mother cells is normal and regular. During diakinesis 17 bivalents are clearly seen scattered within the nucleus (Fig. 1). Metaphase is normal (Fig. 2)

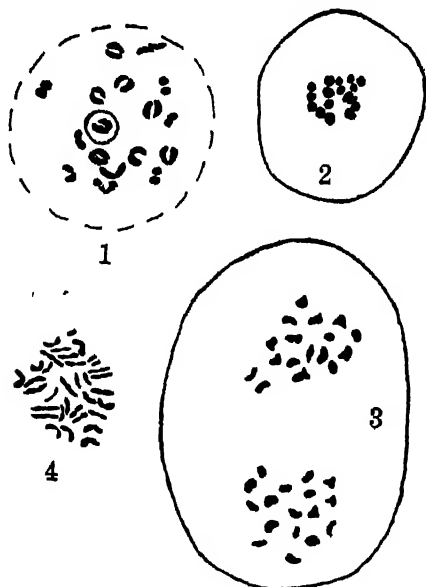


FIG. 1. Diakinesis showing 17 bivalents within the nucleus (scattered drawing); Fig. 2. Metaphase plate showing secondary association; Fig. 3. Second division metaphase with 17 chromosomes in each plate; Fig. 4. Somatic metaphase plate. Figs. 1-3 ( $\times 1,200$ ); Fig. 4. ( $\times 1,800$ ).

and followed by a regular disjunction of bivalents in anaphase. An indication of secondary association between bivalents is apparent in the metaphase plates. The second division takes place after a short interphase, and 17 chromosomes are seen clearly in both the plates (Fig. 3), confirming the haploid number as  $n=17$ . The two spindles may be arranged

parallel (as in the figure), or at right angle to each other.

The somatic plates contain 34 chromosome (Fig. 4), which are very short and vary from  $0.8$  to  $2\mu$  in size.

Among the 7 other genera of the Acanthace: (*Hygrophila*, *Justicia*, *Ruellia*, *Thunbergia*, *Acanthus*, *Eranthemum* and *Dædalacanthus* whose chromosome numbers are known<sup>2,4</sup> only *Ruellia* has 5 species with  $2n=34$  chromosomes.<sup>5</sup> Whether this similarity indicates closer affinity between the two genera remain to be seen, although there is no such indication from pollen<sup>6</sup> or floral morphology.

Thanks are due to Prof. P. Maheshwari for facilities and encouragement.

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Delhi 8,

S. K. MUKHERJEE.

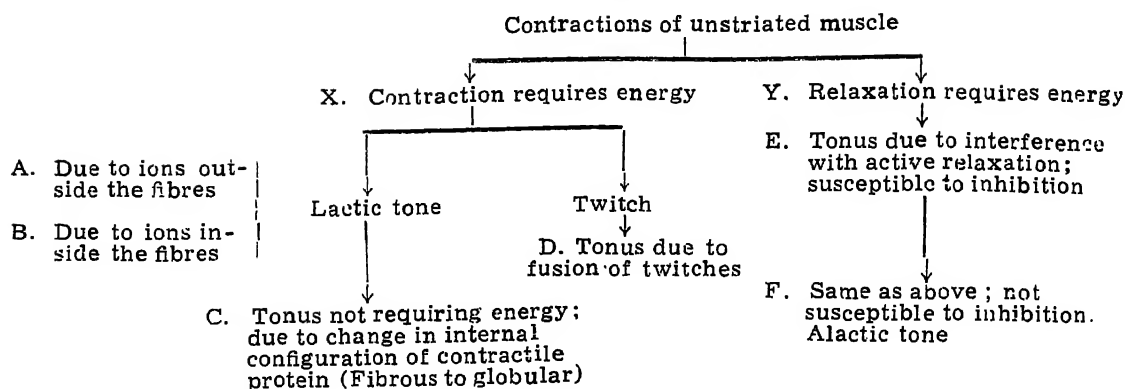
February 6, 1952.

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## MECHANISM OF TONUS IN UNSTRIATED MUSCLE

UNSTRIATED muscle produces sustained tension under many different conditions. These tonic contractions can be divided into two groups, those which are susceptible to prolonged asphyxia and those which are resistant. To the former belong the twitch contraction and lactic tone and to the latter, alactic tone.<sup>1,2,6,7</sup> It has been shown that in frog's and dog's stomach muscles, these two contractions are subserved by different contractile mechanisms. This was shown by experiments in which either contractile mechanism could be mechanically disrupted without affecting the other two.<sup>3,4,5,8,10,11</sup>

These experiments were repeated on *Mytilus* unstriated muscle. In over 12 experiments, it was not found possible to dissociate the twitch contraction produced by alternating or direct currents, from tone by destroying either of these with sudden stretching (Fig. 1). In this muscle, therefore, the two kinds of contraction are subserved by the same contractile mechanism. This is in agreement with the other findings, that active relaxation is absent in this muscle and that its contractile mechanism differs from the other muscles in which active relaxation has been found.<sup>9</sup> The various sustained contractions of unstriated muscle may now be summarised as follows:<sup>5,10</sup>



There are six ways in which unstriated muscle can produce sustained tension. The contraction A, due to ions outside the fibres, and B, due to ions inside the fibres are antagonistic.<sup>12</sup> They are akin to the contracture of

1949, 30, 263. 4. —, *Ibid.*, 1950, 31, 351. 5. —, *Ibid.*, 1951, 33, 165. 6. —, *Curr. Sci.*, 1947, 16, 259. 7. —, *Ibid.*, 1948, 17, 321. 8. —, *Ibid.*, 1951, 20, 130. 9. —, *Ibid.*, 1951, 20, 237. 10. —, *Nature*, 1950, 166, 647. 11. —, *Ibid.*, 1951, 167, 564. 12. Singh, I., *J. Physiol*, 1938, 92, 62.

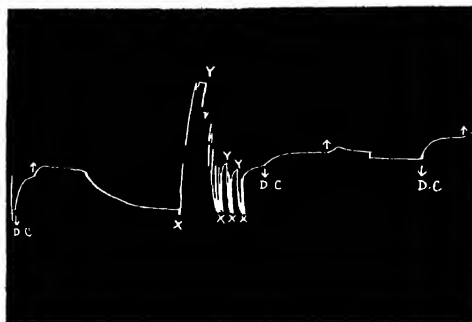


FIG. 1. *Mytilus* muscle. Stimulated with direct current (14 volts for 10 seconds) between arrows at D. C. Put under tension at X, and tension destroyed by sudden stretching at Y.

striated muscle. C is the tonic mechanism of *Mytilus* muscle.<sup>5</sup> D is akin to tetanus of skeletal muscle. E is susceptible to inhibition and F is resistant. F is the basic tone found in all frog's and mammalian unstriated muscle. It is akin to rigor mortis of striated muscle, so that what is a terminal contraction in striated muscle, is a physiological one in unstriated muscle. The contractions of striated and unstriated muscle are therefore closely related. With the exception of C, the group X is susceptible to asphyxia, and group Y is resistant. A contraction starting as D, may pass into A or B and thence into E and finally into F.

Lab. of Physiology, Inderjit Singh,  
Yale University School of Medicine,  
February 16, 1952.

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#### TROPICAL PULMONARY EOSINOPHILIA—PRELIMINARY NOTE ON ANIMAL EXPERIMENTS AND THE HIRST'S PHENOMENON

THE disease Tropical Pulmonary Eosinophilia is very common in India. Four important features of the disease are now recognised, history of persistent cough with or without breathlessness, eosinophilic leucocytosis, miliary mottling on the chest, X-ray in about thirty-five per cent. of cases, and therapeutic response to arsenic in most cases. Earlier confusion<sup>2</sup> of tropical pulmonary eosinophilia with other pulmonary eosinophilias of known etiology like pulmonary schistosomiasis, pulmonary amoebiasis, allergy asthma, etc., may have been responsible for the opinion that tropical pulmonary eosinophilia has multiple causes. The constant features of the disease, however, suggest that a single cause may be involved. Further, in every case, the known etiologic agents of pulmonary eosinophilia are absent.

With reference to the etiology of tropical pulmonary eosinophilia<sup>2</sup> we have the following results to present:

##### In Vivo Tests

A group of 40 mice inoculated intraperitoneally and intravenously with bacteria-free (seitz-filtered) blood and sera of patients shows an increase of eosinophil cells from 2 per cent. to 16 per cent. Blood from such inoculated mice failed to incite a rise in eosinophils in healthy mice.

With rabbits, it was observed that eosinophil cells are almost impossible to distinguish from

pseudo-eosinophil (granulocytes) cells,<sup>6</sup> as the granules of the neutrophils are eosinophilic for the most part.

Progressive increase in eosinophil cells was recorded in the case of five monkeys inoculated intraperitoneally with the blood and sera of patients suffering from the disease. In 19 days, the percentage of eosinophil cells increased from 2 to 14. There has been a corresponding increase in total leucocytic count from 6,000 to 13,000 per c.mm. of blood. The work is being continued.

#### In Vitro Tests

Agglutination of erythrocytes by viral agents, Hirst's phenomenon,<sup>3</sup> has been useful in investigative and diagnostic work<sup>1</sup> and many workers in recent years have demonstrated its applicability to study a number of viral infections. In our work, out of seven patients' sera examined, six have been observed to agglutinate chicken red cells. The hemagglutination titre has not reached more than 1:32 in cases examined (see Table I).

So far as we know, this is the first record of the demonstration of the Hirst's phenomenon in tropical pulmonary eosinophilia. Low hemagglutination titre of the patient's sera and small rise in per cent. eosinophils in animals inoculated with bacteria-free sera, are points worth noting. Whether such co-relation exists between *in vitro* and *in vivo* test cannot be said at present. Work with sputum has, therefore, been taken up with a view to obtain higher hemag-

glutination titre and greater per cent. of eosinophils on experimental animals.

TABLE I

Hemagglutinating activity of sera of patients suffering from tropical eosinophilia with chicken erythrocytes

Patient	Initial two-fold dilution of fluid							
	1	2	3	4	5	6	7	8
1	++	++	++	++	±	0	0	0
2	++	++	+	±	0	0	0	0
3	++	++	++	±	0	0	0	0
4	++	++	++	++	±	0	0	0
5	++	++	+	±	0	0	0	0
6	++	±	+	+	0	0	0	0
7	0	0	0	0	0	0	0	0

Degree of Agglutination:—

++ Complete; + Partial; ± Faintly positive; 0 Negative.

Our thanks are due to Dr. D. L. Shrivastava, Assistant Director (Planning), and Dr. B. Mukerji, Director, Central Drug Research Institute, for their keen interest in the work.

Central Drug Res. Inst., B. M. GUPTA.

K. G. Medical College S. S. MISRA.

& Hospitals, Lucknow, SAMI HAMEED.

January 7, 1952.

\* Working under Fellowship from Indian Council of Medical Research.

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4. Wintrobe, M. M., *Clinical Hematology*, p. 819, Lea and Febiger, Philadelphia, 1949.

### COUNCIL FOR NUCLEAR RESEARCH IN GENEVA

A COUNCIL of Representatives responsible for planning an International Laboratory and organizing other forms of co-operation in nuclear research has been set up with headquarters in Geneva, following a five-day conference organised by UNESCO.

This body will have an independent legal status and will be responsible for all future planning. It will also conclude a special agreement with UNESCO and will co-operate with that organization. Its budget will total \$200,000 to be contributed to by its member states. It is expected that this will lead to the creation of an International Nuclear Research Laboratory, the location of which will be decided later.

The Conference agreed that one task of the Council will be to organize a study group at the Copenhagen Institute for Theoretical Physics. This group will survey the present situation in atomic physics with special regard to the work to be undertaken by European co-operation. It will also study problems which

may be tackled with equipment already in existence and to be operated on a European basis. It will endeavour to stimulate European collaboration by furthering contacts between scientists in different countries and by offering possibilities for younger physicists to take part in the research work carried on in the Copenhagen Institute.

The Council is to consider an offer from Liverpool University to provide special facilities for a number of European physicists to work there. The University has agreed to take four experimental physicists for at least one year, two cyclotron engineers for a shorter period, and one or two theoretical physicists.

Among the forty delegates and observers who participated in the Conference were: Niels Bohr (Denmark), Werner Heisenberg (Germany), and Sir George Thomson (United Kingdom). There were also observers from Austria, Japan and the Council of Europe.

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## REVIEWS

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**Application of the Electronic Valve in Radio Receivers and Amplifiers, Book IV.** By B. G. Dammers, J. Haantjies, J. Otte and H. van Suchtelen. (Published by N. V. Philips' Gloeilampenfabrieken-Eindhoven, Netherlands), 1950. Pp. 024-416. Price Rs. 24.

The authors have produced an excellent treatise dealing with all the details of receiver design in the R.F., I.F. and detector stages and a welcome addition to the limited number of texts available in this field. The next volumes in the series (in preparation), Books V and VI, are meant to deal with the audio and power supply stages. A very desirable feature of the book is the extensive use of graphs and numerical examples based on existing valve types. Although a casual glance at the book shows considerable mathematical symbols, a knowledge of the mathematics of the conventional circuit theory is adequate for understanding the text. Each chapter is followed by extensive references to original papers.

The subject-matter of the book is divided into five chapters: Chapter I deals with R.F. and I.F. amplification, and gives a thorough discussion of tuned circuits, band-pass filters used in the R.F. and I.F. stages, the various methods of coupling the antenna to the first R.F. valve, I.F. stage design, etc. Chapter II deals with the problems connected with frequency changing. Several types of oscillator circuits are discussed in detail and methods of obtaining constant heterodyne voltage over each of the wave bands are discussed. Attention is also given to a consideration of the parasitic effects such as squegging and interaction between oscillator and input circuits. A brief discussion of the transit-time effects and the causes of frequency drift due to the mixing valve are also considered. Chapter III deals with the so-called tracking problem, that is, of maintaining a constant difference between the heterodyne oscillator frequency and that of the input circuits over the whole wave band. Algebraic and graphical methods of calculating the oscillator circuit constants are given. Chapter IV considers the parasitic effects and distortion such as modulation hum, cross modulation, superheterodyne whistles, etc., arising in the R.F., I.F. and mixer stages. Chapter V, the last one in this book, deals with the principles of detection and gives

a detailed discussion of the 'linear' diode detection.

Although the book should find its greatest use in the hands of the receiver designer, it is not much to say that it will also be of use to all those engaged in related fields.

B. S. RAMAKRISHNA.

**Electrical Engineering Economics, Vol. II. Costs and Tariffs in Electricity Supply.** By D. J. Bolton. 2nd Edition (Revised). (Chapman & Hall, London), 1951. Pp. 307. Price 30 sh.

The volume under review is the completely revised second edition of the author's book, first published in 1938, which has been long out of print. As pointed out by the author, the aim of his two-volume book on Electrical Engineering Economics is to give to practising engineers and students a plain account of such elementary economics as most nearly concerns them, together with its application to certain engineering problems.

The book has been, for convenience, divided into four parts, viz., Theory of Price-fixing; Costs; Retail Tariffs; and Power Factor Costs and Tariffs. New material has been included on Marginal cost and Price structure, Classification of cost details. The two new chapters on Allocation of Demand Costs and Load Studies are very useful in understanding the basis of charging commensurate with the individual's contribution to system demand. After discussing the pros and cons of the peak responsibility and demand methods of cost allocation used in the past, the author has shown that the E.R.A. method is a practical improvement on either of the two. He has also indicated the drawbacks in the E.R.A. method and his suggestions for its refinement.

The chapters on General Survey of types of structure and Domestic Tariffs have been completely recast. A new chapter has been added on Time-variable Tariffs and Restrictions in the part on Retail Tariffs. According to the author a scientific tariff should be a combination of two-part tariff based on floor area and time-of-day tariff. A very useful addition for general reference work is the glossary of terms as defined by the British Standards Institution and the Electrical Research Association,

The book meets a long-felt need for an up-to-date work on the theory and practice of Tariff Structure in the electric supply industry. From the students' point of view, addition of more problems and examples would have been welcome.

C. S. GHOSH.

**Stainless Iron and Steel. Vol. I.** By T. H. G. Monnypenny. (Chapman & Hall), 1951. Third Revised Edition. Pp. 523.

When an early pioneer in the field of stainless steels like T. H. G. Monnypenny, publishes a revised edition of his original treatise, the reader would expect a very complete review of the entire development upto the present stage. The expectations are actually fulfilled in this complete and excellent compilation. Besides the stainless steels mentioned in the title, heat-resisting steels are also dealt with.

Chapter I classifies the commercial steels into hardenable, ferritic and non-hardenable austenitic stainless steels. For hardenable steels, the maximum carbon content of which is increased up to 0.8 per cent. the typical example quoted is that of a high carbon valve steel. This steel has proved to be rather brittle and difficult to work. Examples of steels containing either 0.6 or 0.8 per cent. C in combination with 16 to 18 per cent. Cr and additions of molybdenum and copper, which are not considered in the book and which are used frequently for parts requiring higher hardness, wear resistance and cutting efficiency, would have been more appropriate.

Chapter II deals with the forging, rolling, heat treatment, surface hardening, descaling, cold working, machining, welding and soldering and the behaviour of stainless steels during these operations. One important aspect which should belong to this chapter, viz., the casting of such steels, has been omitted. This omission is noticeable especially as a wide range of alloys have been specially developed for casting purposes, and as controlling the primary structure is important because of its very great influence on the hot workability of such steels. The remaining sections, and particularly the one on nitriding stainless steels offer very detailed and complete information.

In Chapter III, the phenomena of corrosion resistance has been dealt with on the basis of the passive film theory only, although other explanations are possible. The attack of different corrosive media and the resistance of the best suited steel compositions under such con-

ditions is the subject of the most extensive part of the book. One of the problems, not yet satisfactorily solved is the corrosion resistance against sulphuric acid. But there are certain developments in this respect which are not reported up to date.

In Chapter IV dealing with the behaviour of heat-resisting steels at high temperatures, the scale-resistance in different atmospheres at temperatures above 500° C. and creep resistance, the development of alloys for the construction of the internal combustion turbine come in for a detailed review. It would have been of interest, if the development in the construction of gas turbines, which is different, had been incorporated. This has led to the development of ferritic steels containing 1 to 2 per cent. molybdenum preferred by the designers because of their lower expansion, and to austenitic steel of the type 16 per cent. Cr., 13 per cent. Ni with titanium or columbium additions.

Because of the very wide application of stainless and heat-resisting steels, the last chapter on the choice of stainless steels for industrial purposes has been limited to some of the most important application purposes only. The metallography of these types of steels has been but briefly mentioned and will be considered as the subject of a second volume "Microstructure and Constitution", which is to be published later. The omissions mentioned above do not in any way diminish the value of the book, which is a really wonderful source of information to students and experts in this special field of metallurgy.

H. SCHRADER.

**Chemistry of Muscular Contraction.** By A. Szent-Györgyi. (Academic Press Inc., New York), Second Edition, 1951. Pp. ix + 162. Price \$ 4.50.

This revised edition of a book published under the same title by the author in 1946 has been enlarged to include another publication of his on "The Nature of Life" (1949). The first edition received some very harsh criticism (cf. K. Bailey, *Nature*, 1947, 160, 550), largely because of the completely unorthodox style and the daring as well as novel approach. In the present edition, the weaker points of the earlier work have been sifted out and new observations are made. Nevertheless, many of the views advanced may yet remain contentious since the author has not considered contemporaneous work not in agreement with his postulates.



Annual Review of Biochemistry has rendered to the progress of Biochemistry. To have maintained the standard of the series ever high and to have kept abreast of the progress in a rapidly expanding field of science, during the last 20 years, constitute an achievement of which Dr. Luck, who sponsored the venture, may be proud. In the present volume, twenty-one topics are reviewed, each one by an active authority on the subject. It is a matter of some satisfaction to readers of *Current Science* that one of our leading organic chemists, Dr. T. R. Seshadri, has reviewed the Biochemistry of Natural Pigments—a subject to which he has been devoted during his entire research career.

Other topics covered by the volume are: Biological oxidations by R. Wurmser, Non-oxidative, Non-proteolytic Enzymes by W. R. Frisell and L. Hellerman, Carbohydrate Chemistry by H. O. L. Fischer and D. L. MacDonald, The Polyuronides by C. L. Hinton, Chemistry of the Lipids by K. F. Mattil, The Chemistry of Amino Acids and Proteins by K. Bailey and F. Sanger, X-ray Crystallographic Studies of Compounds of Biological Interest by R. B. Corey, Nucleic Acids, Purines and Pyrimidines by J. Baddiley, Lipid Metabolism by S. Gurin and D. I. Crandall, The Metabolism of Proteins and Amino Acids by H. Borsook and C. L. Deasy, Biochemistry of Steroids by S. Lieberman and K. Dobriner, Fat-soluble Vitamins by H. Dam, Nutrition by H. J. Almquist, Biochemistry of Cancer by A. M. Brues and E. S. G. Barron, Biochemistry of Antibiotics by R. L. Peck and J. E. Lyons, Immunochimistry by M. M. Mayer, The Metabolism of Drugs and Toxic Substances by R. T. Williams, Biochemical Genetics by N. H. Horowitz and H. K. Mitchell, Carbohydrate Metabolism by S. P. Colowick and N. O. Kaplan and water-soluble Vitamins by G. Emerson and K. Folkers.

We wish the series a great future no less prosperous and brilliant than its past.

Advances in Enzymology and Related Subjects of Biochemistry. Vol. XI. Edited by F. F. Nord. (Interscience Publishers, Inc., New York), 1951. Pp. viii + 471. Price \$ 9.00.

The volume contains nine articles. The first one relates to a discussion of the nature of entropy and its role in biochemical processes by Herbert Gutfreund of Cambridge. Defining the thermodynamic function, entropy, both from the historical and mathematical points of view, the author proceeds to describe various physical processes which may be of some importance

in the mechanism of chemical and biological reactions. The second article on Reactions at Interfaces in Relation to Biological Problems by J. F. Danielli and J. T. Davies is one of fundamental interest to biochemists in general, and enzymologists in particular. The vital significance of surface is realised if attention is called to the very large surface area of the cell membrane, nuclear membrane, chromosomes and other discreet entities such as mitochondria, vacuoles, golgi apparatus, etc., which generally constitute the cell. In addition, the surface offered by the colloidal molecules like proteins, carbohydrates and nucleic acids and by the particulate micelles composed of fatty emulsions, etc., add to the enormity and complexity of surfaces and surface reactions. The article forms a brilliant exposition of this intriguing subject.

The discussion of the highly controversial subject of chlorophyll fluorescence in relation to the intriguing process of photo-synthesis presented by E. C. Wassink, serves to clarify the position of the problem and stimulate further studies. E. S. Guzman Barron has presented a critical and stimulating survey of the extremely reactive thiol groups in relation to biological activity.

A review of the Pectic Enzymes representing a generic group of enzymes, which have attained industrial importance, has been made by Hans Lineweaver and Eugene F. Jansen. Enzymatic synthesis of polysaccharides is a recent subject of great significance to enzymology. Edward J. Hehre who has picturesquely described the reaction as a biological type of polymerisation, has presented a thought-provoking review of the present position of this new and promising field of biochemistry.

The other three chapters of the volume relate to the Biological Transformations of Starch, by Stanley Peat; Chemical Investigations of Alliin; The Specific Principle of Garlic, by Arthur Stoll and Ewald Seebach; Some Problems of Pathological Wilting in Plants, by Ernst Gäumann. A cumulative index—author and subject—covering all the 11 volumes, is appended to this volume. Professor Nord is to be congratulated on this brilliant array of inspiring contributions which comprise the eleventh volume of the Advances.

Hydroponics: The Bengal System. By J. Sholto Douglas (Oxford University Press), 1951. Pp. xii + 147. Price Rs. 6.

In 1929, Prof. W. F. Gericke, of the University of California, reported an interesting

application of the principle of water culture and named his method of growing plants 'hydroponics'. The yields thereof were comparatively high: e.g., potatoes at the rate of 2,500 bushels to the acre where the average soil production was only 116 bushels; and tomatoes yielded fruits in 60 days, some averaging 24 lb. per plant.

In the booklet under review, the author has given a popular account of his experimental studies on the soilless culture of plants carried out during 1946-49 at the Bengal Government Experimental Farm at Kalimpong in the Darjeeling District. It is reported to require neither elaborate equipment nor expensive appliances. The hydroponic troughs may be made of wood, concrete, asphalt impregnated mats or roofing felt, asbestos sheets, bricks and mortar, mud plaster, puddled alkali-treated clay, iron or steel, which have all been used with success. The troughs are filled up to a depth of six inches with coarse inert aggregate, which may consist of gravel, crushed stone, cinders, broken brick or granite chips of  $\frac{3}{4}$ " to  $\frac{1}{2}$ " size, to which has been added a certain proportion of sand or residual dust. This mixture, which is described as a novel feature of the Bengal system, is the hydroponic substitute for soil for supporting plant roots. Irrigation water may be supplied by means of a bamboo piping system or from a rubber hose. Details of other items and about the various operations, such as sowing of seeds, transplanting seedlings, preparing suitable mixtures of chemicals and applying the nutrients, together with a number of diagrams and photographs illustrating the technique and some of the results, are also given, so that an aspiring hydroponicist could easily learn the new method. By this method forty different crops (rice, wheat, maize, potatoes, soya-beans, oats, beet-root, peas, tomatoes, etc.) were grown successfully during the experimental seasons in the period 1946-49, and the crop yields and the cost of production are recorded. The hydroponic yields in most cases were much higher than the yields obtained by ordinary agriculture: e.g., tomatoes at the rate of 140 tons per acre where the soil production was only 5 to 10 tons per acre. The estimated revenue from the hydroponicum is also very encouraging: the grower would be left with a net profit, at a conservative estimate, of Rs. 20,000 yearly from each acre of his soilless culture installation.

The Bengal system may perhaps appeal more to townspeople interested in gardening, but who lack garden space. In addition to full instructions for the setting up of the hydroponicum

and its operation, the publication contains short notes on other systems of soilless culture and a brief, non-technical account of the elements of plant nutrition and deficiency symptoms, which would be found useful by the amateur gardener as well as the commercial grower. The book is well printed although a few typographical errors have slipped in (e.g., on for ion on page 64, line 8).

S. C. P.

Curare and Anticurarare Agents. By K. R. Unna, D. Bovet, W. E. M. Paton and 28 other authors. *Annals of the New York Academy of Sciences*, Vol. 54, Art. 3. Pp. 297-530. Price \$ 4.00.

This is a comprehensive monograph reflecting the trend of research on curare, synthetic curare-like compounds and their antagonists.

The partial clarification and extension of the existing knowledge on the effects of *d*-tubocurarine on the central and autonomic nervous system and the studies on the action of curarising agents at the neuromyal junction are ably presented by McIntyre and others. Dutcher describes the isolation and identification of additional alkaloids in *chondrodendron tomentosum* by the use of counter current distribution and chromatographic techniques. There is much activity in this field, but it is evident that unanimity of opinion does not exist on all fronts.

The renaissance in the history of curare-like drugs stems largely from the remarkable work of Bovet and his colleagues. Paton has given a critical review which throws considerable light on the numerous contrasts in experimental results between decamethonium and similar substances causing neuromuscular block. The effect of modification of the structure of decamethonium on its pharmacological properties has been discussed by De Beer, *et al.*

From being merely a tool in the hands of the pharmacologists, curare and the curarising drugs have now come to occupy a prominent place in the clinicians' armamentaria, and the surgeons' anaesthesia. Mention has been made of the clinical uses of *d*-tubocurarine in the various neuro-muscular disorders ranging from muscle spasm to spasticity, the place of curarising agents in convulsive and electroshock therapy and in various other groups of disorders.

Experimental details in evaluation of curarising drugs in man and the presentation of all the latest trends in research, render this a very desirable volume in the hands of research workers in this field of study.

M. SIRSÍ.



**Elementary Genetics.** By Wilma George. (Macmillan & Co., Ltd., London), 1951. Pp. vi + 171. Price 10 sh. 6 d.

The sub-title of this book is "The Physiology of Descent" and this describes the mode of treatment adopted. The fundamentals of genetics are briefly explained and modern developments in physiological genetics are indicated. The book begins with an account of cell theory, cell division and gametogenesis, and then passes on to a chapter on Mendelian heredity. Four more chapters deal with the topics, linkage, sex determination, mutation and chromosome mutations. The next four chapters deal with the Gene, its nature, its action and interactions, and its role in taxonomy. The last chapter gives a very brief account of the vast topic, genetics and evolution.

The book is meant to describe briefly to the non-specialist student the fundamental principles of genetics, and to explain the significance of recent developments in physiological genetics. Because of the novelty of treatment, the book is a useful addition to text-books in genetics. Limitation of space has prevented the author from dealing adequately with the abstruse topic: gene action as revealed by biochemistry. For understanding the latter half of the book, the student must know general biology. In page 103, a reference is made to the organising agent and its role in embryology. A student who knows this amount of biology, must be quite familiar with cell theory, cell division and gametogenesis. The pages devoted to these subjects could well have been devoted to explaining in greater detail the main theme of the book, and thus making the book more useful.

C. G.

**Vitamins: A Digest of Current Knowledge.** By Leslie J. Harris. (J. & A. Churchill Ltd., London), 1951. Pp. xii + 244. 84 Illustrations and 111 Structural Formulæ. Price 15 sh. net.

This book provides a brief account of current knowledge about the vitamins for beginners in the study of vitaminology. The simple style and the historical approach in each case do indeed help in fulfilling this objective to some extent. The emphasis however has been throughout on clinical aspects rather than on biochemical functions of the different vitamins. Such important topics as relation of micro-organisms to the study of vitamins, the anti-vitamins and vitamin assay procedures do not find a place in this 'digest'. There is also no discussion of vitamin interrelationships nor is the account concern-

ing the chemistry and physiology of folic acid and vitamins B<sub>12</sub> up to date. The booklet is likely to be of use to the clinician and the dietitian rather than to the biochemist. The glossary of medical terms, the short but useful bibliographies and the numerous plates demonstrating vitamin deficiency syndromes are distinct features that recommend themselves very strongly.

A. SREENIVASAN.

**Table of Dielectric Constants of Pure Liquids.** By A. A. Maryott & E. R. Smith. N.B.S. Circular 514. (Govt. Printing Office, Washington, 25 D.C.), 1951. Pp. iv + 44. Price 30 cents.

The book contains the values of "static" dielectric constants of more than 800 substances in the liquid state, together with literature references upto 1950 presented in a concisely tabulated form; data are given both for  $E$  and  $dE/dt$ , which would be found very useful by research workers in the field.

#### Books Received

**Hydrocarbons.** (Published by the Faraday Society), 1951. Pp. 339. Price 35 sh.

**Inventories of Apparatus and Materials for Teaching Science, Vol. 3. Part 3.** UNESCO 19, Avenue Kleber, Paris, 1951. Pp. 139. Price \$ 2.50.

**Intermediate Geometry.** By L. J. Lacey. (M/s. Macmillan & Co.), 1951. Pp. xii + 363. Price 10 sh.

**Fault Calculations.** By C. H. W. Lackey. (M/s. Macmillan & Co.), 1951. Pp. xi + 295. Price 30 sh.

**The Lipids, Their Chemistry and Biochemistry, Vol. I (Chemistry).** By Harry J. Denel, Jr. (M/s. Interscience Publishers), 1951. Pp. xxiv + 982. Price \$ 18.50.

**Chemistry of Carbon Compounds, Vol. I.** Edited by E. H. Redd. (M/s. Elsevier Publishing Co.), 1951. Pp. xxi + 777. Price not given.

**Laboratory Instruments, Their Design and Application (First Edn.).** By J. Home Dickson and A. Elliott. (M/s. Chapman & Hall), 1951. Pp. 414. Price 32 sh.

**Rockets, Missiles and Space Travel, Second Edition.** By Willy Ley. (M/s. Chapman & Hall), 1951. Pp. xii + 436. (22 Figs.) Price 30 sh. net.

**Food and Food Products (The Chemistry and Technology of), Vol. III.** By Morris B. Jacobs. (M/s. Interscience Publishers), 1951. Pp. xxx + 1773-2580. Price \$ 15.00.

*The Theory of Electromagnetic Waves* (A Symposium held under the auspices of the Washington Square College of Arts and Science). (Interscience Publishers), 1951. Pp. viii + 393. Price \$ 6.50.

*Prism and Lens-Making*. By F. Twyman, Hilger and Watts, Ltd., London, 1951. Pp. viii + 629. Price 58 sh. net.

*On Indian Insect Types*, Part I. By S. Bashood Alam. Edited by M. B. Mirza, Muslim University, Aligarh, 1951, 74, (9 plates). Price Rs. 5-8-0.

*The Science of Flames and Furnaces*. By M. W. Thring. (M/s. Chapman & Hall, Ltd.), 1952. Pp. 416. Price 42 sh.

*Carburation*, III Edition, Volume II. By Charles H. Fisher. (Chapman & Hall), 1952. Pp. xv + 279. Price 36 sh.

*Power System Analysis*. By J. R. Mortlock and M. W. Humphrey Davis. (Chapman & Hall), 1952. Pp. xv + 384. Price 45 sh.

*Quantum Theory of Matter*. By John C. Slater. (McGraw Hill Book Co.), 1951. Pp. xiv + 528. Price not given.

*Outlines of Farm Management*. By R. K. Misra, College of Agriculture, Gwalior, 1951. Pp. 48. Price not given.

*The Influence of Hormones on Enzymes*. Edited by Roy Waldo Miner. (Annals of New York Academy of Sciences), 1951. Vol. 54. Art 4, Pp. 531-728. Price \$ 3.50.

*The Kamar*. By S. C. Dube. (Universal Publishers, Ltd., Lucknow), 1951. Pp. xii + 216. Price Rs. 12-8-0.

*Mitchourine Lysenko*. By Jacob Segal. (Les Editeurs Francis, Paris), 1951. Pp. 141. Price Fr. 225.

*Testing of Measuring Equipment*. (A Manual for Weights and Measures Officials. National Bureau of Standards Handbook No. 45. U. S. Department of Commerce, Washington, 1951). Pp. vii + 205. Price not given.

## SCIENCE NOTES AND NEWS

### Antituberculous Thiosemicarbozone Compounds

With reference to a note of the above title in *Current Science*, 1951, 21, 10, Mr. S. Banerjee of the Bengal Immunity Research Institute, Calcutta, writes that work on similar thiosemicarbozone compounds has been published earlier by U. P. Basu and Samir Banerjee in *J. Ind. Chem. Soc.*, 1951, 28, 466.

### Madras University Lectureships, 1952-53

Applications for Lectureships will be received by the Registrar, not later than the 31st March, 1952. The lectures are ordinarily to be delivered before the end of January, 1953.

(1) *The Maharaja of Travancore Curzon Lectureships* (3)—Three lectures of the value of Rs. 250 each, relating to (a) Medicine, Clinical, (b) Engineering and (c) Agriculture.

(2) *The Sir Subrahmanya Ayyar Lectureship*: Value Rs. 250.

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(3) *Dr. Elizabeth Matthai Lectureship*: Value Rs. 300.

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to a subject having special reference to the requirement of Women and Children.

(4) *The Dr. A. Lakshmanaswami Mudaliar Lectureship*: Value Rs. 500—

A course of not less than three lectures should be delivered at Madras on any subject pertaining to Medicine in any of the various departments including Medical Education, Medical Relief and Public Health and History of Medicine.

### Johnston Pump Co. Scholarship

The Johnstone Pump Company have placed at the disposal of the Government of India a scholarship to be awarded to an Indian in ground-water development at the California Institute of Technology, U.S.A.

Applications are to reach the Ministry of Education, Governments of India, New Delhi, on or before April 15, 1952. Particulars and prescribed application forms can be obtained from the Ministry of Education, Government of India, New Delhi (Scholarships Division).

### Plant Ecology of Arid and Semi-Arid Regions of S.-E. Asia.

Dr. F. R. Bharucha, Professor of Botany, Institute of Science, Bombay, has been commissioned by the UNESCO to prepare a report on

the plant ecology of the arid and semi-arid regions of Afghanistan, India and Pakistan. Information relating to the subject on (i) Geography and Geology, (ii) Climate, (iii) Soils, (iv) Hydrology, (v) Agriculture, (vi) Forests, (vii) Salt lands, (viii) Erosion, (ix) Sand dunes, (x) Floras, (xi) Physiological Studies on Transpiration, (xii) Past History of the arid and semi-arid zones and (xiii) Schemes, if any, worked to ameliorate these conditions, will be gratefully received and suitably acknowledged by him.

#### Award of Research Degree

The University of Poona has awarded the Degree of Doctor of Philosophy in Chemistry to Sri. P. G. Tulpule, for his thesis entitled "Studies on Fat Metabolism".

#### Indian Vegetables Oils as Fuels for Diesel Engines

In the fourth edition of this valuable bulletin which has been just now published by the *Council of Scientific and Industrial Research*, the information has been completely revised and brought up to date. Copies of this publication are available from the Publications Division, 20, Pusa Road, New Delhi-5. It is priced Re. 1 per copy, packing and postage extra.

#### Optical Instruments Manufacture at Dehra Dun

The Ordnance Factory at Dehra Dun is now in a position to offer a range of instruments such as research microscopes, dissecting microscopes, photographic enlargers and micron readers, for civilian consumption. Attempts are being made to cater, in adequate measure, to the needs of universities and colleges. An illustrated article describing some of the instruments being manufactured by the factory is to be found in the *J.S.I.R.* (Jan. 1952).

#### Antidote for Beryllium Poisoning

The Argonne National Laboratory, Chicago, has announced that aurin tricarboxylic acid (ATA) seems to offer promise in this correction. This chemical combines with beryllium salts by a similar reaction to that of dye fixation by metallic salts. The resultant co-ordination compound is a non-toxic substance. According to *Chemical Age* (Jan. 5, 1952), ATA has proved to be an excellent antidote in laboratory cases of animal poisoning with beryl-

lium, cases in which the amount of beryllium given would otherwise have been fatal. If ATA proves to be a satisfactory antidote to beryllium toxicity with humans, the use of this metal in atomic pile construction will become more likely.

#### Radioisotopes in Research

The Oak Ridge Institute of Nuclear Studies, Tennessee, is offering four-weeks' courses in the techniques of using radioisotopes in research at the rate of about six courses each year. Although most of the courses are over-subscribed by qualified United States' scientists, some courses may have one or more vacancies available for foreign scientists. Foreign nationals will however be accepted only when applications are approved by the applicants' Embassy or Legation and the United States Department of State.

The course is divided into laboratory work, lectures on laboratory experiments, general background lectures, and special-topic seminars. Laboratory experiments concern the following subjects: (a) Use and calibration of instruments, (b) Purification and separation of radio-active materials, and (c) Application of various radioisotope techniques of interest to investigators in all fields of research.

The seminars cover such topics as the principles and practices of health physics, design of radio-chemicals laboratories, dosimetry, and effect of radiation on living cells and use of isotopes in animal experimentation.

#### Asiatic Society

The following Officers of the Society were duly elected for 1952: *President*: Dr. S. K. Mitra, *Vice-Presidents*: Dr. M. Z. Siddiqui, Mr. K. P. Khaitan, Sir Paul Benthall and Dr. S. C. Law, *General Secretary*: Prof. J. M. Sen and *Treasurer*: Hon'ble R. P. Mookerjee.

#### Bulletin of the Electrochemical Society

The India Section of the Society have constituted an Editorial Board with Dr. R. M. Burns as Chairman and Dr. T. L. Ramachar as Regional Editor, for the publication of the *Journal*. The first number for January issued recently is of topical interest, and contains a section of abstracts from current literature, which should be quite useful to all electrochemists in India.

## ANNOUNCEMENT

### JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH

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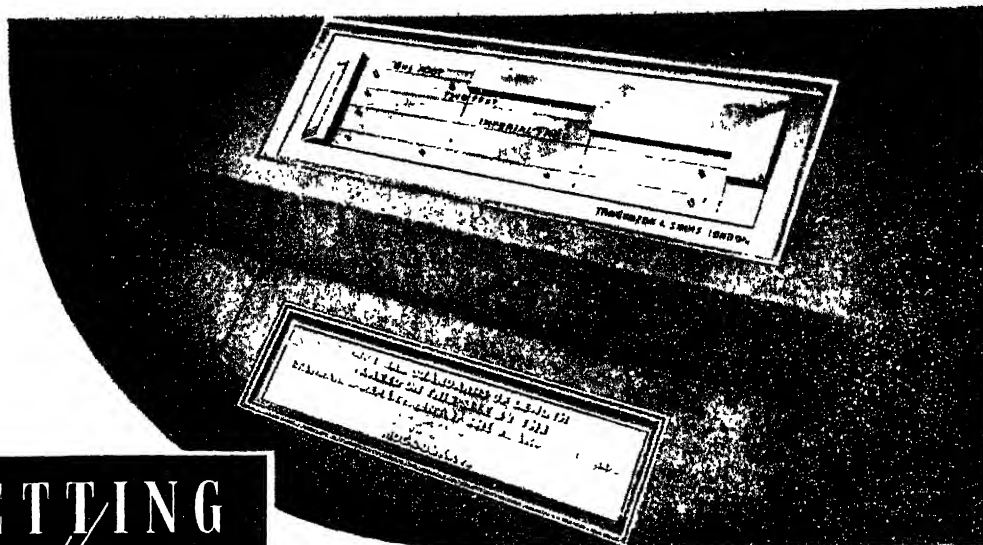
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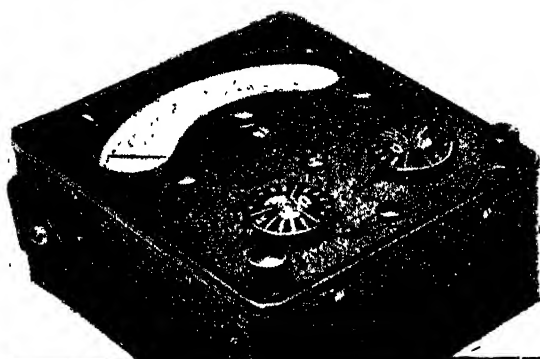
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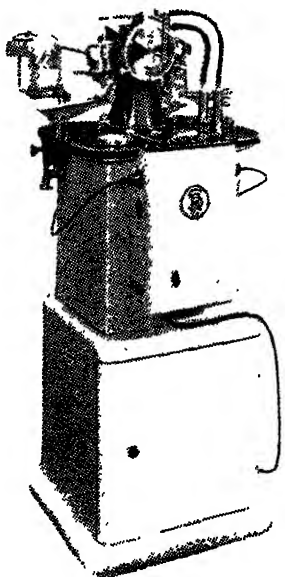
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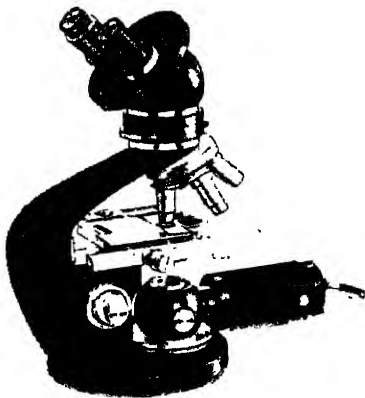
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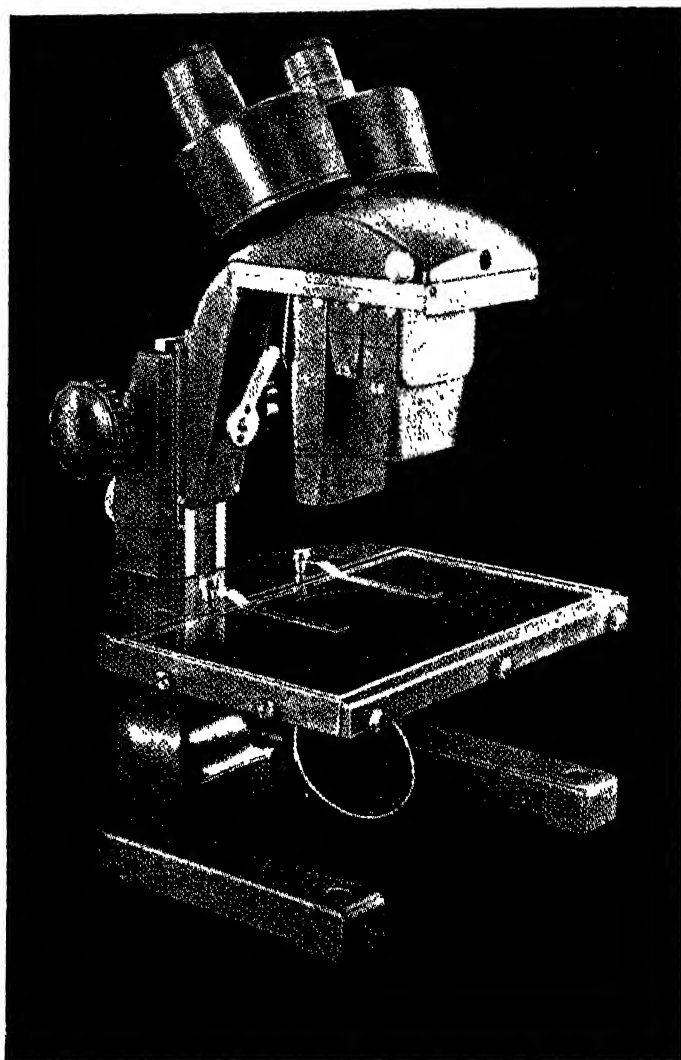
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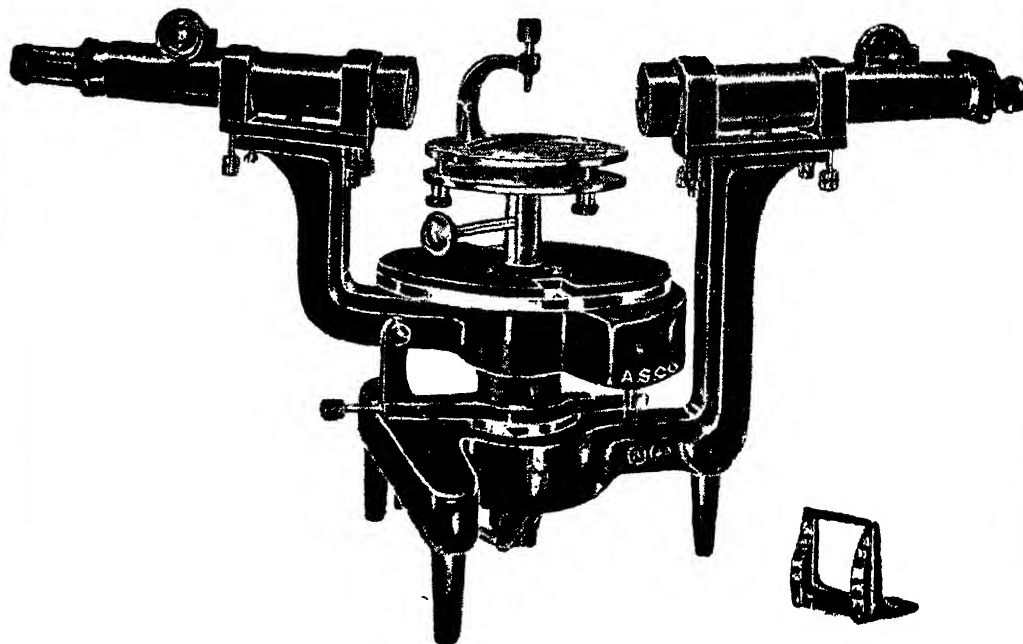
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# Current Science



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## THE INTERNAL COMBUSTION ENGINE INDUSTRY IN INDIA\*

OF the various types of Internal Combustion Engines, the diesel engine industry has become well established in India and a few firms have, on production, engines of indigenous design. These engines are usually of the single cylinder horizontal and vertical type, generally used as a power-plant or drive for pumps. Most of the component parts for the engines are now made in India, but the finer components like the injection pump and nozzle are yet being imported. A report, however, is now being prepared by the National Physical Laboratory of India and the Secretary to the I.C.E.R. Committee on the possibilities of undertaking the manufacture of injection pumps and nozzles. The experience of one firm in India in the use of high duty cast irons for the cylinder head and crankshaft should prove extremely valuable in saving the use of scarce

alloying elements like nickel, vanadium, molybdenum, etc. The diesel engine industry is now looking forward to the production of high-speed heavy duty transport vehicle engines, which should naturally be of the multicylinder type. An important bottle-neck in this is the combustion chamber which is invariably guarded by rigorous patents abroad. It is now proposed to take up a research scheme on the development of a combustion chamber suitable for this purpose, and it is hoped that in the next three or four years when this development may be fruitful, the Indian industry may undertake manufacture of multicylinder engines of their own design.

The automobile industry is gradually gaining ground in the country, but of the various firms who are engaged in this section of the industry, there is only one that has gone into the production of engines even on a limited scale. It is, however, gratifying to note that there is now one complete machine shop for the machining of all principal parts of an engine, and a foundry is getting ready for the preparation of all major castings.

\* Abstract of Address by Dr. J. C. Ghosh, Chairman, Internal Combustion Engine Research Committee, at the Symposium on Problems Relating to the Development of Internal Combustion Engine Industry in India, held on the 5th April 1952, at the Indian Institute of Science, Bangalore.

In this connection, I may mention two factors which should receive the attention of everyone interested in the development of a large-scale industry, *viz.*, the importance of the design and development section, and the inspection department. In all mass production on assembly line principles, the design and production planning offices hold the key to the success of any endeavour. One has only to see the catalogue of parts listed for the assembly of an engine to realise the enormous design and planning effort that has gone into the production of a simple engine. We often find that in India little importance is given to this aspect of production.

Standardisation and inspection play an equally important part. If the consumer is to have faith in an indigenous article, it is absolutely necessary that the product is of defined and consistent quality. From the producer's point of view, of course, the need for standardisation is essential when provision has to be made for exchange of parts from one unit to another. The variety of materials and processes that goes into the making of an engine naturally demands a capable inspectorate having authority to reject doubtful products. A greater realisation of the importance of this fact should help place our industry on a much better footing, and our products on a level comparable to similar products from abroad.

Speaking in broad terms about an industry of the type and magnitude of the Internal Combustion Engine, one might remember that the manufacture of an engine is usually achieved by a group of subsidiary industries, each of which is specialising in a component part of the engine. There are certain factories exclusively organised for the manufacture of such parts as spark plugs and injection pumps and nozzles, and many subsidiary organizations for the manufacture of standardised pistons and rings and the casting or forging of crankshafts and connecting rods. Such a subsidiary industry has not yet started in India, though again it is very encouraging to note that one firm has now taken up the manufacture of pistons and rings of standardised design and specifications. In this connection, I may mention that valuable reports have been drawn up on the design and manufacture of spark plugs, pistons and rings; and I commend them to those who are interested in the manufacture of these component parts.

During the last three years, considerable interest has been shown in the development of the gas turbine power plant. It is true that the reciprocating engine industry itself has not yet

developed fully, and it will be still sometime before we can claim to have indigenous designs on production lines. All the same, the gas turbine has become such an important power plant that it has been considered advisable to start at least two main centres of research and development in this field. Some facilities for advanced instruction in the design, operation and testing of gas-turbines are also now available in the laboratory of the Indian Institute of Science.

The main problems relating to the Internal Combustion Engine industry fall into two groups: (a) fuels that have to be burnt in engines, and (b) materials which may be used in the fabrication of engines.

The major fuel for the Internal Combustion Engine is yet the liquid fuel. About 40 per cent. of the liquid fuel in use belongs to the gasoline class. Our own resources in this direction are poor. But two refineries have now been started in India which should give us greater confidence in regard to a regular supply of gasoline. When thermal cracking had reached what appeared to be the final stage of development a few years ago, the maximum octane number level was rather low. However, with the advent of catalytic cracking the petroleum industry developed another tool which has made possible the production of a larger percentage of gasoline from a barrel of crude oil at a higher octane number level than could be attained by thermal cracking.

This brings us to the question of high octane fuels. During the last two decades, as the demand for high-powered engines increased there has been a continuous increase in the octane numbers of gasolines used in engines. Increased power has demanded higher compression ratios, and this has resulted in every means being employed to improve the octane numbers. The discovery of tetra-ethyl lead and other octane increasing compounds has given further fillip to this race for higher and even higher compression ratios. Recently, however, there is a shift in emphasis in obtaining high compression ratios. Instead of going in for higher octane fuels, an attempt is being made at obtaining the same result by altering the design of the combustion chamber. Studies in this field call for fundamental investigations on the nature of combustion of liquid fuel particles, the movement of the flame front and the nature of chemical reaction during the movement of the flame.

The next important liquid fuel is the heavier diesel fuel. The two-stroke diesel engine, in

some ways, is the future reciprocating power plant of the world. The major advance in diesels to-day is not so much in the improvement in the quality of fuels as in the super-charging of these engines. Super-charging is better than the method of increasing the compression ratio, because of the considerably less maximum pressures in the former case, thus permitting less heavy stress-bearing components and therefore a lighter engine.

Alcohol comes as the next major liquid fuel. Considerable importance is being attached to the power alcohol industry by the Government, and before long, we may have sizeable resources on hand to make greater use of this fuel. About 20 per cent. mixture with motor gasoline has now come to be recognised as a suitable fuel for most vehicles. But the approach to this problem of utilizing alcohol perhaps needs a revision. Serious attempts should be made to design an engine primarily for running on a high percentage mixture of alcohol and gasoline. A discussion on liquid fuels would be incomplete to-day without a few words on kerosene. Being not subject to any duty, superfine kerosene is nearly half as cheap as petrol. Of course, it has gained exceptional value as a fuel with the advent of the gas turbines, which run

mostly on kerosene when used for air transport. We, in this country, should be especially interested in the use of kerosene as a fuel for our agricultural machinery.

Finally, reference must be made to solid fuels which are now being increasingly recognised as the future economic fuel for stationary power plants. We have in this country almost inexhaustible sources of low grade coal, and it should be our earnest endeavour to find a power plant that can burn it economically and with a high efficiency. The combustion of pulverised coal presents many problems like ash deposition, carbon deposition, corrosion of metal chambers, etc., which I have referred to earlier. But the most interesting study is the combustion of coal particle itself. I hope the Fuel Research Institute will take up in hand this fundamental problem for careful investigation.

I hope that the co-operation between Government, the Council of Scientific and Industrial Research, the industry and research workers, which is so evident in this Symposium, will extend to the development of the Internal Combustion Engine Industry in India. May this co-operation lead to the establishment of a flourishing industry in the country!

#### PROGRESS IN TECHNICAL EDUCATION

IN the course of his address to the 19th meeting of the Central Advisory Board of Education held recently, the Hon'ble Maulana Abdul Kalam Azad, Minister for Education, Government of India, observed as follows:

On the recommendations of the All-India Council for Technical Education and the Scientific Man-Power Committee, large grants have been made to Universities and other higher technical institutions. In the first phase of the development programme, fourteen technical institutions in different parts of the country were selected and capital grants amounting to over Rs. 1½ crores and loans over Rs. 32 lakhs were approved in 1949 for improving their capacity and standards. Out of the amounts promised, over Rs. 90 lakhs as grants and Rs. 30 lakhs as loans have already been paid. During the same period, over Rs. 135 lakhs have been paid as capital and almost half a crore as recurring grants to the Indian Institute of Science, Bangalore. As a result, the Institute is in a position to-day to undertake post-graduate teaching and research in many of the fundamental branches of science and technology. The Delhi Polytechnic has also

been greatly developed and will serve as the Faculty of Technology of the Delhi University.

Besides, the Indian Institute of Technology at Kharagpur, which will impart teaching of the highest standard and provide facilities for research in many of the most important aspects of engineering and technology, was formally opened in August last year. The staff, recruited from many countries, include some of the best experts available in the field.

In this connection, grateful acknowledgment is made to the assistance received through the UNESCO Technical Assistance Programme, under which the services of several distinguished technical experts were made available. We have also received the offer of 9 Scholarships and Fellowships for our students and equipment worth over \$ 100,000. In addition, a number of our teachers and other educational workers have been given the opportunity to receive training or participate in study tours under the Fulbright and allied schemes. All these are evidences of international co-operation in the field of education, which are welcome not only on their own account but also because they help to promote better international understanding.

## VARIOLITES FROM CHITALDRUG DISTRICT, MYSORE STATE

C. S. PICHAMUTHU

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AS early as 1904, Mr. P. Sampat Iyengar<sup>1</sup> had noticed that the "Grey Trap" near Jogimardi often contained "small rounded protuberances which stand out prominently on weathered surfaces". While he thought it probable that "these nodules may represent the spherulites in the trap", he believed that this peculiar structure was "the result brought about by movement of the extrusive trap". Some of them were also considered by him to be amygdaloids.

In 1930, the present writer while describing the trap rocks of the Chitaldrug Schist Belt, had occasion to examine some of the specimens and slides collected by Mr. Sampat Iyengar, and he found that the spots, patches and nodules found in these traps were not amygdaloids, but were either segregations of secondary materials or varioles.<sup>2</sup> Recent field work has shown that this interpretation was correct, and this note gives a brief description of these interesting variolites from the Chitaldrug Area.

The occurrence of pillow lavas of Dharwar age, containing well-defined typical pillow structures, was recently reported by the writer<sup>3</sup> from the Chitaldrug District. In several parts of this volcanic field, variolitic traps have been developed. An almost continuous zone is seen to stretch in a north-south direction from about a mile south of Chitaldrug Town to Kurbarmaradikere, a distance of nearly five miles. Very good localities are (i) the road cutting near Kunchiganhal, (ii) the valley south of

Ingladhah, and (iii) the western bank of Kurbarmaradikere Tank.

These variolitic rocks present a very characteristic appearance in the field. Due to their resistance to weathering, the nodules stand out as rounded prominences. In fresh specimens, the colour of the rock is uniformly grey, and it is sometimes difficult to decipher the variolitic structure. But, when altered the nodules remain grey or bleach somewhat whitish, whereas the matrix rock turns slightly brownish, and so the contrast is heightened, and the structure is very clearly seen.

The nodules, which are usually about quarter to half inch and rarely one inch in diameter, are quite compact, and often drop out leaving smooth-walled cavities which resemble vesicles. A radial structure is sometimes discernible in the nodules (Fig. 1). In rare cases a concentric zoning can be seen (Fig. 2).

Under the microscope the borders of the varioles are often seen to be demarcated by specks of leucoxene or iron ore. A well-marked radial texture is not clearly visible, but interlocking sheaves can sometimes be seen. Sometimes the nodules are composed of numerous radial groups of crystals not giving perfect black extinction crosses, but only irregular dark brushes. The pyroxenes are almost completely altered, leaving an aggregate of fibrous amphibole. Tiny crystals of pale green amphibole are also found. The original feldspars are rarely seen. Epidote, zoisite and clinozoisite



FIG. 1. Variolite, about 1 mile south of Ingladhah. On the left, several varioles have dropped off leaving smooth-walled depressions. In the centre of the specimen, the varioles exhibit a crude radial structure.

FIG. 2. Variolite, about  $\frac{1}{2}$  mile north of Kurbarmaradikere. The specimen is somewhat altered and the light coloured varioles are clearly seen. A concentric structure is visible in some.

FIG. 3. Variolite from road-cutting near Kunchiganhal. The varioles are large in size and many of them are compound.

are abundantly developed. An irresolvable glassy base full of minute dark specks is present. Thin irregular veins composed of microcrystalline aggregates of quartz and feldspar are seen traversing both nodules and rocky matrix.

Two chemical analyses of these variolitic traps were made by Sri B. Sadasiva Raju, Chemist, Mysore Geological Department. The analyses were made on samples dried at 105° C. The weight percentages are given in Table I and the normative values in Table II.

TABLE I  
Weight percentages

	1	2
SiO <sub>2</sub>	53.08	54.03
Al <sub>2</sub> O <sub>3</sub>	12.48	13.22
Fe <sub>2</sub> O <sub>3</sub>	0.48	2.19
FeO	9.35	8.75
MgO	8.84	7.34
CaO	8.94	8.36
Na <sub>2</sub> O	2.00	2.45
K <sub>2</sub> O	1.97	2.75
H <sub>2</sub> O	2.14	1.89
TiO <sub>2</sub>	1.50	0.01
P <sub>2</sub> O <sub>5</sub>	tr	0.04
MnO	..	..
Total	100.78	101.03
Specific gravity	3.05	3.08

TABLE II

## Norms

	1	2
Quartz	0.48	..
Orthoclase	11.67	16.12
Albite	16.76	20.43
Anorthite	18.90	17.23
Diopside	20.38	19.57
Hypersthene	26.53	20.89
Olivine	..	1.14
Magnetite	0.69	3.24
Ilmenite	2.88	0.15
Apatite	..	0.10

Potash is higher than soda in the second analysis and this is reflected in the normative content of 16.12 per cent. of orthoclase. The thin microcrystalline acid veins traversing these rocks probably contain orthoclase; but its presence has not been definitely determined. In chemical composition, these variolites show great differences from the Jogimardi traps.<sup>4</sup>

1. Sampat Iyengar, P., *Recs. Mys. Geol. Dept.*, 1905, 6,
78. 2. Pichamuthu, C. S., *Half-Yearly Journ. Mys. Univ.*, 1930, 4, 10. 3. —, *Curr. Sci.*, 1950, 19, 110-111.
4. —, *Half-Yearly Journ. Mys. Univ.*, 1930, 4, 5.

## INTERNATIONAL CENTRE OF TYPE CULTURE

THE "Centre de Collections de Types Microbiens", at 19, rue Gesar-Roux, Lausanne (Switzerland), keeps an index of microbes and viruses cultivated in the principal bacteriological laboratories in the world. Its latest catalogue thus contains appropriate references to 9,000 different strains which are available on request.

Scientists requiring cultures of strains not

available in their own country may obtain them on direct application to the Centre which will then arrange for the order to be executed by the appropriate laboratories. Through the services of the Centre, the UNESCO Science Co-operation Offices have been able to assist in the past large numbers of research workers in all parts of the world.

## INDIAN DAIRYMAN

THE INDIAN DAIRY SCIENCE ASSOCIATION, who have recently taken over the entire responsibility of publishing the *Indian Dairyman*, must be congratulated on the improvements effected in the format and contents of the Journal. Nearly double its former size, the March issue of the Journal contains many interesting features among which the article

on "Indigenous Milk Products of India" by K. K. Iya and H. Lakshminarayana, deserves special mention. A "Questions and Answers" column has also been opened, which should prove of interest to dairymen in general.

Our heartiest good wishes for the future progress of the Journal, devoted to the popularisation of Dairy Science.

## WHERE DO THEOSOPHY AND SCIENCE MEET ?\*

UNDER the able guidance of Prof. Kanga, many contributors and monographists have collaborated to give us a comprehensive survey of the achievements of modern science and have endeavoured to locate and specify where exactly Theosophy and Science meet.

The war-weary and science-saturated world is to-day unhappy, notwithstanding the phenomenal advancement in values and conditions of civilized life. If a braver and newer world is at all to emerge, it is clear that the peace, joy and bliss of the spirit described in Theosophy and Vedanta should be recaptured and reproduced in concrete life. Technological living and civilization should be founded and re-oriented on a truly spiritual basis. The whole personality of man should be trained and developed. Such are the cardinal conclusions argued and established in the volume under notice.

Part III of Volume II entitled 'God', contains fourteen contributions. Part IV entitled 'Law' has sixteen. While it is not difficult to understand the significance of the title 'Law' (as many of the contributions deal with principles, theory and practice of modern law), the part bearing the title 'God' is rather intriguing. As it is, the part stands devoted to the discussion of psychology, psychical research, anthropology and mythology, and no contributor has focussed attention on the special or distinctive problem of God, with reference to the scientific and philosophical arguments for and against the existence of God and connected problems.

For obvious reasons, it is not possible to single out this or that individual contribution for special commendation, as all maintain a high standard of scientific exposition and research. Nevertheless, it can be said that Swami Sivananda's contribution on *Yoga* (pp. 230-254) would be found particularly illuminating, with special reference to *Yoga* methodology and practice. The contribution clears up many of the Western misconceptions about the technique and goal of *Yoga*, and points out that *Yoga* is neither a sort of magic nor self-hypnotism, but constitutes really a carefully planned out system of psycho-physical practices, whose goal is nothing short of holy communion with Divinity in all its supremacy and splendour. But it seems to us that his dictum that 'Yoga is for all' is to

make the goal seem a little too easy of reach by every one.

The contribution on "Astrology" (pp. 379-395) by Charles E. Luntz, it is to be feared, betrays some confusion. The earlier part is contradicted by the latter, in which, however, the author expresses the hope that astrology would be accorded recognition like psychology, in due course.

The English rendering of the Sanskrit verse on page 549 is grammatically incorrect.

When all is said and done, there still remains the big question why Theosophy should seem so anxious to meet Science? Is it nervous or lacking in self-confidence? Or, is there any universal dictum that recognition by Science alone is the hall-mark of academic respectability?

For, it can argumentatively be established that *Vedanta*, Vedantic methodology and Vedantic experiences commence just where the experimental sciences end and where their jurisdiction terminates. Theosophy must be prepared to take such a stand, or abandon any claim to be recognised as a system of philosophy, leading to Self-Realisation.

In the opinion of the reviewer, science should grow *more* scientific and theosophy should grow *more* theosophical, while a meeting should not be forced between the two.

None of these comments, however, would in any manner affect the general excellence of Prof. Kanga's achievement. Prof. Kanga and other contributors may indeed be said to have rudely shaken international complacency, and pointed out clearly that unless concerted attempts are made to eliminate poverty, disease, unemployment, racial bias and inequalities, the crash of contemporary civilisation is rather inevitable. The "Epilogue" contributed by the Editor is a remarkably fine performance. His call to modern men and women to build our civilization anew on a truly spiritual basis, we are sure, will not fail to evoke a generous response from one and all; for the measure of response to such a call would also be an index of whether there is at all any future for our civilization.

Prof. Kanga and his associates are unreservedly to be felicitated on the publication of this volume which is bound to stir and stimulate international thought as preparatory to the much to be desired spiritual reawakening of mankind.

R. NAGARAJA SARMA.

\* Where Theosophy and Science Meet—Edited by D. D. Kanga. Vol. II. The Adyar Library, Adyar, Madras. Pp. xi plus 610. Price Rs. 15.

## LETTERS TO THE EDITOR

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### ENERGY OF AN ISOLATED FLUID SPHERE

THE energy within a definite fixed spatial volume in a gravitational field is given by a well-known integral whose integrand contains certain pseudo-tensor quantities.<sup>1</sup> In using this integral to calculate the energy within a sphere  $r=R$  in a gravitational field described by a line-element of the form

$$ds^2 = -e^{\alpha} dr^2 - r^2 e^{\beta} (d\theta^2 + \sin^2 \theta d\phi^2) + e^{\gamma} dt^2, \quad (1)$$

$$\alpha = \alpha(r, t), \beta = \beta(r, t), \gamma = \gamma(r, t)$$

one has to evaluate these pseudo-tensor quantities in terms of the "Cartesian" co-ordinates  $x, y, z$ . Again, the radius  $R$  of the sphere has to be a constant. On transforming the co-ordi-

nates  $(r, \theta, \phi)$  of (1) to  $(x, y, z)$  by the usual substitutions one finds that

$$ds^2 = -e^{\frac{\beta}{\alpha}} (dx^2 + dy^2 + dz^2) - \frac{e^{\frac{\gamma}{\alpha}}}{r^2} (x dx + y dy + z dz)^2 + e^{\gamma} dt^2 \quad (2)$$

We have evaluated the integral for the energy for the field described by (2) and have found it to be given by

$$U = \frac{1}{2} [e^{(\gamma-\alpha)/2} r e^{\beta} (e^{\alpha-\beta} - 1 - r \partial \beta / \partial r)]_0^R. \quad (3)$$

We have also found that (3) will continue to represent energy even when  $R$  is not a constant, but any function of  $t$ .

Generally  $\alpha, \beta, \gamma$  are assumed to be continuous functions of  $r$  and  $t$  everywhere in the field. It will be very satisfying from the physical point of view, to have the expression (3) for

the energy of the sphere  $r = R(t)$  to be a continuous function of  $R$  in the field. In that event  $\partial\beta/\partial r$  should be a continuous function of  $R$  for all values of  $t$ .

Vallabh Vidyanagar,  
Anand,  
January 28, 1952.

P. C. VAIDYA.

1. Tolman, R. C., *Relativity, Thermodynamics and Cosmology*, 1934, p. 227.

## EQUATIONS OF FIT FOR SPHERICAL DISTRIBUTIONS

SEVERAL authors have discussed the equations of fit over a surface of discontinuity, say  $r = a(t)$ , in a gravitational field described by a line-element of the form

$$ds^2 = -e^{\alpha} dr^2 - r^2 e^{\beta} (d\theta^2 + \sin^2 \theta d\phi^2) + e^{\gamma} dt^2, \\ \alpha = \alpha(r, t), \beta = \beta(r, t), \gamma = \gamma(r, t) \quad (1)$$

Generally the co-ordinates  $r$ ,  $t$  and the coefficients  $\alpha$ ,  $\beta$ ,  $\gamma$  of the metric are assumed to be continuous over all such boundaries of the field. But different authors have postulated different behaviours for the first derivatives of  $\alpha$ ,  $\beta$ ,  $\gamma$  over  $r = a(t)$ . Lemaitre<sup>1</sup> has used a line-element of the type (1) with  $\beta = 0$  and has postulated the continuity of only one derivative, viz.,  $\partial\gamma/\partial r$ , over the boundaries of the field. Einstein and Strauss<sup>2</sup> have again used a line-element of the type (1) but with  $\alpha = \beta$ , and have assumed the continuity of  $\partial\alpha/\partial r$  and  $\partial\gamma/\partial r$  explicitly, while the continuity of  $\partial\alpha/\partial t$  and  $\partial\gamma/\partial t$  occurs implicitly in their calculations. Recently Clark<sup>3</sup> has postulated the continuity of all the first derivatives of  $g_{\mu\nu}$ .

We have studied this problem of the equations of fit for fields described by (1) and our conclusions are: (i) in addition to the usual continuity of  $r$ ,  $t$  and the functions  $\alpha$ ,  $\beta$ ,  $\gamma$ , it is necessary that  $\partial\beta/\partial r$  be a continuous function throughout the field described by (1); (ii) the other first derivatives of  $\alpha$ ,  $\beta$  or  $\gamma$  need not be continuous everywhere in the field. As a matter of fact, their behaviour over any surface of discontinuity in the field cannot be postulated but is determined by the physical properties of the gravitational situations under consideration.

As already mentioned elsewhere<sup>4</sup> the continuity of the function  $\partial\beta/\partial r$  is necessary to ensure that the function representing the energy of a sphere of radius  $R(t)$  in the field is a continuous function of  $R$  for all values of  $t$ . We have now worked out a general solution for the gravitational field of a star which illustrates the conclusion (ii) above, different situations within the star demanding different behav-

iours for the other first derivatives of  $\alpha$ ,  $\beta$  or  $\gamma$ . This solution and other details will be published elsewhere.

Vallabh Vidyanagar,  
Anand,  
January 28, 1952.

P. C. VAIDYA.\*

\* Springer Research Scholar, University of Bombay.

1. Lemaitre, A. G., *Mon. Not. Roy. Astr. Soc.*, 1931, 91, 493.
2. Einstein and Strauss, *Rev. Mod. Phys.*, 1945, 17, 120.
3. Clark, G. L., *Proc. Roy. Soc. Edin.*, 1, 1949, 62, 429.
4. Vaidya, P. C., *Curr. Sci.*, 1952, 21, 95.

## MAGNETIC SUSCEPTIBILITY OF MIXED CRYSTALS OF POTASH AND CHROME ALUMS

THE constituents of the mixed crystals that were the subject of study here, are potassium alum  $[KAl(SO_4)_2 \cdot 12H_2O]$  and chrome alum  $[KCr(SO_4)_2 \cdot 12H_2O]$  one of which is diamagnetic and the other paramagnetic.

The mixed crystals were prepared by dissolving the two alums in water in various proportions. The concentration of each specimen studied was determined by chemical analysis as it had no relationship with the concentration of the solution from which the crystals were grown. Susceptibilities of the mixed crystals were determined by the Oxley<sup>1</sup> balance.

Table I contains the results. Here  $\chi$  represents mass susceptibility while  $\chi_M$  ( $\chi \times M$ ) is the gram molecular susceptibility.  $M$ , the molecular weight of the mixed crystal, is taken to be  $M_1 M_2 / [M_2 \tau_1 + M_1 (1 - \tau_1)]$  where  $M_1$  and  $M_2$  are the molecular weights of the constituent alums and  $\tau_1$  is the fraction by weight of one of the alums in the mixed crystal.

Percentage of potash alum by weight	$\chi \times 10^6$ observed	$\chi_M \times 10^3$ observed	$\chi_M \times 10^6$ calculated	Difference $\Delta \chi_M$ (obs. - cal.) $\times 10^6$	Per cent
1 100	- 0.58	-275.1	..	..	..
2 89.69	+ 0.799	+381.3	327.3	54.0	0.36
3 82.94	+ 1.942	+923.3	724.3	204.0	0.67
4 49.37	+ 7.00	3405.0	2744.0	661.0	1.26
5 45.00	+ 7.82	3812.0	3010.0	802.0	1.30
6 35.5	+ 9.102	4460.0	3598.0	862.0	1.44
7 0	+11.7	5841.0	..	..	..

It will be observed that the susceptibilities do not follow a linear relationship with concentration, but are larger than what is warranted by the linear law ( $\chi$  calculated). The maxi-



um deviation  $\Delta\chi_M$  was found to be  $9.6 \times 10^{-6}$  at a concentration of 40% of potashum as read from a graph. In order to understand these results the extraparamagnetic susceptibility was expressed in terms of Bohr magnetons per an ion of chromium by means the formula.

$$P_{\text{EXCESS}} = \frac{\sqrt{3RT}(\Delta\chi_M)}{\mu_B}$$

where  $\mu_B$  is the Bohr magneton per gram molecule (5564). The last column gives the Bohr magnetons thus calculated. It looks as if the maximum deformation which the paramagnetic distortion of the susceptibility of crystal has undergone is 1.46 Bohr magnetons.

The usual explanation for the observed low paramagnetism of the chromium salt is that the orbital moments are quenched and that the spins alone take part in the paramagnetism. Hence the effective magneton number is  $\sqrt{S(S+1)}$  it becomes in the case of chromium equal to 3.87 where  $S$  is  $3/2$  agreeing with the experimental value 3.82.<sup>2</sup> We have in the present investigation a release of paramagnetism of maximum amount 1.46 Bohr magnetons so that the maximum paramagnetism that a chromium ion can exhibit is  $1.46 + 3.82 = 5.28$ . This indeed agrees with the theoretical value of the effective magneton number obtained from  $\sqrt{L(L+1)} + 4S(S+1)$  equal to 5.21, where  $L$  is equal to 3. Thus it looks as if putting the paramagnetic substance with a diamagnetic one helps to release the otherwise quenched orbital paramagnetism.

The author is glad to acknowledge that this problem originated from Prof. S. Bhagavantam of the Osmania University. He is thankful to Prof. M. Ramanadham for his guidance.

Physics Department,  
Presidency College,  
Madras,  
February 11, 1952.

V. D. P. SASTRI.

J. Oxley, *Phil. Trans.*, 1914, 214A, 109. 2 Bates, F., *Modern Magnetism*, Cambridge University Press, 8, p. 130.

#### SPACE GROUP OF MAGNESIUM AND SODIUM ACETATES

MAGNESIUM ACETATE TETRAHYDRATE  $[\text{Mg}(\text{H}_3\text{COO})_2 \cdot 4\text{H}_2\text{O}]$  crystallises from aqueous solution at room temperature. The crystals belonging to the monoclinic system were needle-shaped and elongated along the  $c$ -axis. Layer measurements on  $\text{Cu K}_\alpha$  oscillation photographs taken with the axis of rotation parallel

to each of the three principal axes gave the following lattice constants:  $a = 8.5$ ,  $b = 11.7$ ,  $c = 4.7 \text{ \AA}$  and  $\beta = 94.9^\circ$ . These lead to the ratios  $a:b:c = 0.72:1:0.40$  in good agreement with the previously reported morphological values:  $a:b:c = 0.7128:1:0.403$  and  $\beta = 95^\circ 37'$  (Groth<sup>1</sup>). Taking the density to be 1.453, the number of molecules per unit cell comes out to be 1.96, i.e.,  $Z = 2$ . There were no systematic absences in the reflections  $hkl$ . Hence the unit cell is primitive. A careful study of a complete series of  $c$ -axis oscillation photograph reveals that  $0k0$  is absent when  $k$  is odd, showing thereby the presence of a two-fold screw axis along  $b$ . If Groth's assignment to the prismatic class is accepted, the space group may be  $C_{2h}^{2h} - P2_1/m$  or  $C_{2h}^{2h} - P2_1/c$ . Oscillation photographs about the  $b$  axis showed no systematic absences in the  $h0l$  reflections. Hence magnesium acetate tetrahydrate must belong to the space group  $C_{2h}^{2h} - P2_1/m$  with two molecules per unit cell.

Sodium acetate trihydrate ( $\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$ ). Morphological studies show that the crystal class is  $C_{2h}$  with axial ratio  $a:b:c = 1.18:1:0.996$  and  $\beta = 111^\circ 43'$ . This substance also crystallises from aqueous solution with the  $c$ -axis as needle axis. Measurements made with rotation and Weissenberg photographs around the three principal axes yielded the values  $a = 12.4$ ,  $b = 10.5$ ,  $c = 10.3 \text{ \AA}$  and  $\beta = 112.1^\circ$ . These lead to the ratios  $a:b:c = 1.18:1:0.99$ . Assuming the density to be 1.45 (Groth) the number of molecules per unit cell comes out to be 8.02, i.e.,  $Z = 8$ . Zero level and first level equi-inclination Weissenberg photographs about the  $c$ -axis reveal that the only systematic extinction is the absence of  $hkl$  when  $h+k$  is odd. The cell is thus  $C$ -centered. The space group may therefore be either  $C_{2h}^{2h} - C2/m$  or  $C_{2h}^{2h} - C2/c$ . Zero level Weissenberg photographs about the monoclinic axis  $b$  did not show any systematic absences in the  $h0l$  reflections indicating thereby the absence of a glide plane. Hence the space group must be  $C_{2h}^{2h} - C2/m$ . Further investigations are being carried out.

I am grateful to Prof. R. S. Krishnan for his interest in the present work. I am also indebted to Dr. G. N. Ramachandran for the discussions I had with him.

Physics Department, V. M. PADMANABHAN.  
Indian Institute of Science,  
Bangalore,  
March 7, 1952.

1, Groth, *Chemische Kristallographie*, 3, p. 64.

### THE COMPLEX BAND SPECTRUM OF NICKEL BROMIDE

FOLLOWING the work on the band spectrum of nickel chloride published previously,<sup>1</sup> that of nickel bromide has been obtained from  $\lambda$  3,900 to  $\lambda$  5,000 Å. As in NiCl, two  ${}^4\Pi - {}^4\Sigma$  transitions designated as 'a' and 'b' have been identified with a common ground state of vibrational frequency  $\omega_e'' = 313$ . The wavenumbers of the Q heads as obtained in the (0, 0) sequences of the two systems are:

System	Q <sub>4</sub>	Q <sub>3</sub>	Q <sub>2</sub>	Q <sub>1</sub>
a	24017.9	23906.4	23789.2	23658.1
b	22688.6	22581.5	22461.6	22341.9

Another system is also identified and designated as 'γ'. For this the values of  $\omega_e' = 294.9$ ,  $\omega_e'' = 317.2$  cm.<sup>-1</sup> and  $\nu_e = 21790.7$  cm.<sup>-1</sup>

Details of the analysis will be published elsewhere.

Dept. of Physics, V. G. KRISHNAMURTY.  
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March 26, 1952.

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### A NEW RECORD OF AN EQUISETALIAN CONE FROM RANIGUNJ COALFIELD, INDIA

A CONE compression showing resemblance with the fructifications of the family *Equisetaceae* was found in the shales associated with the coal seams of Ranigunj stage in the Ranigunj Coalfield (West Bengal). Cones of some species of *Equisetites* have been described by Kidston,<sup>4</sup> Hall,<sup>3</sup> and Erdtman.<sup>1</sup> Fructifications of *Phyllothea* were described by M'Coy<sup>5</sup> from New South Wales and by Zeiller<sup>6</sup> from Asia Minor, while that of *Schizoneura australis* by Etheridge<sup>2</sup> from Australia. So far fructifications of *Equisetaceae* have not been reported from Indian Gondwanas.

This specimen is a compression with carbonised matter still preserved at some places. It is broadly elliptical in outline with rounded apex and a slender stalk at the base (Fig. 1). It measures 30 mm. in length exclusive of stalk and 15 mm. at its widest part. On the surface of the compression are seen polygonal discs closely fitting with one another. These discs

appear to be the peltate heads of the stalked sporangiophores arranged in whorls on the axis. In the centre of the discs are seen circular marks which must have been the points of



FIG. 1. An Equisetalian cone from Raniganj (actual size)

attachment of the sporangiophores with the peltate heads. Diameter of the polygonal discs is about 2 mm. and that of the circular elevated mark in the centre is about 1 mm. The compression at its broadest part of the short axis bears 5 to 6 polygonal discs and 12 such discs are countable along the long axis of the cone. A detailed description of the cone will be published elsewhere.

I am grateful to Dr. K. R. Surange for the interest he evinced in this work and for his guidance.

Birbal Sahni Institute of P. N. SRIVASTAVA.  
Palaeobotany,  
Lucknow,  
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\* These were inaccessible to the author.

### CHLORINATION OF ILMENITE

THE production of titanium tetrachloride by the chlorination of ilmenite is of particular importance to India since this country possesses large deposits of the ilmenite ore. Details of chlorination of titanium dioxide,<sup>1</sup> titanomagnetite,<sup>2</sup> sphene<sup>3</sup> and rutile<sup>4</sup> are given in literature; but, very little information is available on the direct chlorination of ilmenite. Patent literature<sup>5</sup> on the subject indicates that the temperature of chlorination ranges from 600°

to 1,200° C. A systematic work on the chlorination of Travancore ilmenites is undertaken in this laboratory and the following are some of the important features of the investigation:

In the investigations carried out by the present authors, the titanium ore ( $\text{TiO}_2 = 58.9\%$ ,  $\text{Fe}_2\text{O}_3 = 28.3\%$ ,  $\text{FeO} = 5.0\%$ ,  $\text{MnO} = 0.4\%$ ), was crushed to -200 mesh, intimately mixed with pulverized charcoal and chlorinated in a tubular electric furnace. Titanium tetrachloride and ferric chloride formed were condensed in a flask and the uncondensed vapours were absorbed in sodium hydroxide solution. The residue left over in the furnace at the end of the experiment and the products of chlorination were analysed for iron and titanium by a slight modification of the method of Hope and co-workers.<sup>6</sup> In all the experiments, the amount of the mixture to be chlorinated was about 5 g.; the duration of chlorination was one hour and the rate of passing chlorine was 4 litres per hour. The results are given in Tables I to III.

Table I indicates that chlorination for one hour at 600° C. converts 95.6% of titanium dioxide into the tetrachloride but Pamfilov and Shtandel<sup>2</sup> have obtained a yield of 98%

TABLE I

Effect of temperature on chlorination of ilmenite

Amount of carbon added for 100 g. of ore = 60 g

Temp. of chlorination ° C.	$\text{TiO}_2$ chlorinated %	$\text{Fe}_2\text{O}_3$ chlorinated %
600	100	100
700	95.8	97.4
800	95.6	90.7
500	92.8	81.3
400	49.9	70.0
300	11.4	38.2
200	nil	nil

TABLE II

Effect of carbon on the chlorination of ilmenite

Temperature of chlorination = 500° C.

Carbon added on the weight of ore in %	$\text{TiO}_2$ chlorinated %	$\text{Fe}_2\text{O}_3$ chlorinated %
60	92.8	81.3
50	93.6	86.0
40	92.5	89.1
30	89.8	90.9
20	84.0	92.7
10	42.3	96.8
7	7.6	89.5

TABLE III

Effect of various catalysts on the chlorination of ilmenite

Amount of carbon added for 100 g. of ore = 30 g.

Amount of catalyst added for 100 g. of ore = 1 g.

Temperature of chlorination = 400° C.

Catalyst used	$\text{TiO}_2$ chlorinated %	$\text{Fe}_2\text{O}_3$ chlorinated %
Pyrites (Fe)	60.0	70.0
$\text{MnO}_2$	62.4	77.2
$\text{CuO}$	73.2	86.7
$\text{PbO}$	74.9	84.5
$\text{Ca}_3(\text{PO}_4)_2$	76.6	83.2
$\text{CeO}_2$	81.3	89.0
Without catalyst	49.9	70.0

by chlorinating titanomagnetite for six hours under similar conditions. Table II indicates that 30% of carbon on the weight of ilmenite is optimum for total chlorination of ilmenite. The study on the effect of catalysts on the chlorination indicates that the chlorination can be effectively carried out even at 400° C. under optimum conditions; while the temperature given in literature ranges from 600° to 1,200° C. The reduction of chlorinating temperature is of very great importance since high temperature favours the corrosion of the equipment by the chlorine gas. Details of the work will be published elsewhere.

Our thanks are due to Dr. B. Sanjiva Rao for suggesting the problem.

Dept. of General Chemistry, D. P. KHARKAR.  
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Bangalore-3,  
March 28, 1952.

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#### PRELIMINARY NOTE ON METHIONINE EXCRETION IN LATHYRISM

TWENTY-FOUR hours Methionine excretion in 24 normal persons and 22 lathyrism cases who were still consuming *L. sativus*, has been estimated

by the method of Albanese, *et. al.*<sup>1</sup> The values are given in Table I. When the patients give up taking *L. sativus* and substitute it by other pulses the methionine excretion immediately rises (Table I). The standard deviation indi-

	No. of cases	Methionine Excretion (mg./24 hrs)
1. Normal	24	447 ± 120
2. Lathyrism (taking <i>L. sativus</i> )	22	84 ± 47
3. Lathyrism (given up <i>L. sativus</i> )	6	379 ± 106

Statistical analysis of 1 & 2 :

$$t = 139.7; p = < .01.$$

cates the wide distribution of the excreted methionine which is not unexpected. The decreased excretion in lathyrism is due to a toxic factor present in *L. sativus* which is under investigation.

We are aware that the Albanese method gives much higher methionine values in urine than the microbiological method. We are inclined to agree with Tomich<sup>2</sup> that this may be due to conjugation of methionine with some factor, rendering it unavailable to the assay organism.

In lathyrism, the methionine excretion falls because a structural change takes place due to the toxic factor present in *L. sativus*.

The experimental data were completed in May, 1950. We are indebted to the Bihar Board of Medical Research for a Junior Research Fellowship to one of us (L.M.C.)

Dharbhanga Medical College,

Laheriasarai,

Bihar,

March 10, 1951.

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### NITROGEN AND PHOSPHORUS ABSORPTION BY WHEAT

THE relationship between the utilisation of nitrogen and phosphorus by plants has been worked out by a number of investigators.<sup>1,2,3,5,6,7</sup> In our field experiment, nitrogen was applied in different forms of organic manures and inorganic combinations and phosphate was applied either alone or with potash as well. The wheat crop during 1942-43 followed maize and jowar in kharif and in general the nitrogen available was poor as shown by low nitrogen recoveries.

The wheat crop during 1943-44 was after fallow and general nitrogen availability was more as shown by substantial nitrogen recoveries. The ratios of nitrogen and phosphate uptake by wheat varied from 1.64 to 1.89 under different treatments while the same were as high as 2.51 to 2.88 in 1943-44. The work of Subbiah<sup>8</sup> and Desai and Subbiah<sup>4</sup> on cation anion relationships in plants indicates that, being on the anion side the absorption of nitrogen and phosphate would be governed by their relative availability at the time of growth. This would explain the present observation that by fallowing increased uptake of nitrogen has taken place at the expense of phosphate.

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### SOIL PERMEABILITY

VARIOUS aspects of soil permeability have been studied by previous workers.<sup>1,3,4,5</sup> But, the effect of temperature of dehydration of the soil on the permeability changes with time has not been studied so far. A study of this aspect of subject has revealed interesting features.

The Gangetic alluvial soil of Delhi (India) was chosen for the study. Permeability measurements were carried out by employing the vertical tube permeameter and adopting the constant water-level arrangement. The soil was dehydrated at 60° C., 150° C., 225° C., 360° C., 600° C., 800° C. and 1,000° C. The permeabilities of each one of these dehydrated soils, along with those of the normal soil at room temperature (about 30° C.) have been measured at 35° C. in a thermostat. The changes in permeability with time have been indicated in Fig. 1.

The common features of the permeability-time curve of any soil are, the initial decrease of the permeability to a minimum, the subsequent increase to a maximum and the final decrease which is a slow and continuous process.<sup>1,3,4</sup> All these changes are normally exhi-

bited when the soil is under prolonged submergence in water.

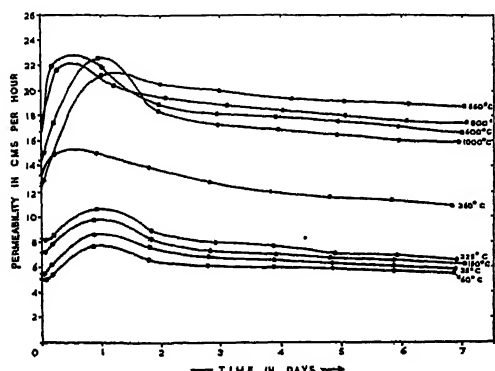


FIG. 1. Permeability of soils dehydrated at different temperatures

All the soil samples dehydrated at the different temperatures retain the above features. But the permeability-time curve shows a lateral shift with the progressive increase in the temperature of dehydration of the soil. The soil dehydrated at 60° C. suffers a decrease in permeability. With further increase in the temperature of dehydration upto 650° C. the permeability steadily increases. Above 650° C., the soil suffers a decrease in permeability. Between 650° C. and 1,000° C., the reproducibility of the permeability-time curve becomes less accurate.

The permeability of a soil for water is essentially a capillary flow phenomenon. Of the total porosity of a soil, it is the non-capillary porosity (wider porosity) that is believed to be responsible for the permeability, whereas the capillary porosity (finer porosity) determines the water-holding capacity.<sup>2</sup> The increase in permeability with increase in the temperature of dehydration of the soil from 60° C. to 650° C. indicates an increase in the non-capillary porosity, i.e., of the wider pores. Wider pores can be produced by the increase in the size of the soil particles. It follows then that higher temperatures facilitate the aggregation of the smaller soil particles into bigger particles. This mechanism is quite probable in view of the high temperature of dehydration.

When the normal soil is dehydrated at 60° C. there is however a small decrease in permeability. This decrease indicates that the soil suffers a small shrinkage on dehydration. As a result of this shrinkage, the porosity decreases and consequently the permeability also decreases.

The decrease in permeability when the tem-

perature of dehydration is raised from 650° C. to 1,000° C. indicates a decrease in total porosity, and this is probably due to a certain amount of incipient fusion of soil particles at the high temperature, resulting in a decrease of the porosity.

The above mechanism of the changes taking place in the soil when the soil is subjected to dehydration at higher temperatures is very interesting indeed. Low temperatures of dehydration like 60° C. bring about only the shrinkage of the soil reducing the porosity whereas high temperatures upto 650° C. bring about aggregation of the smaller soil particles into bigger aggregates. Above 650° C. the soil seems to suffer an incipient fusion resulting in a decrease of the porosity.

The authors are grateful to Dr. D. S. Kothari for evincing keen interest in the work.

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January 10, 1952.

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#### THREONINE IN BENGAL GRAM

In an investigation on the excretion of amino acids in urine in relation to age, rats have been maintained on a vegetable protein diet in which the protein was solely contributed by Bengal gram (*Cicer arietinum*). The composition of the diet was as follows: Starch 26.5 parts, Bengal gram 48.5 parts, Sugar 11 parts, Oil 10 parts, Salt mixture 4 parts. The rats received in addition, vitamins A and D and crystalline vitamins of the B complex in adequate doses. As shown later, the rats on this diet did neither show a negative nitrogen balance, nor any impairment of growth.

Lal<sup>1</sup> has recently reported the absence of threonine in Bengal gram. Wolf and Corley<sup>2</sup> have reported that the amino acid threonine is essential for the maintenance of a positive nitrogen balance and this observation has been further confirmed by Burroughs, et al.<sup>3</sup> Rose<sup>4</sup> in 1930 observed that when a mixture of 19 of the then known component amino acids of protein was incorporated in the ration of young rats as the sole source of nitrogen rapid losses

of weight occurred and later Meyer and Rose<sup>5</sup> found that the inclusion of threonine brought about comparatively rapid gains in weight. Thus a diet containing Bengal gram as the sole source of protein should have resulted in a negative nitrogen balance and also impairment of growth if it was lacking in threonine.

Nitrogen balances were determined every month on the diet described above. Table I contains the relevant data for a period of six months. At no period was a negative nitrogen balance obtained. The rats were also weighed every week and the growth curve illustrated in Fig. 1 makes it clear that no loss of weight

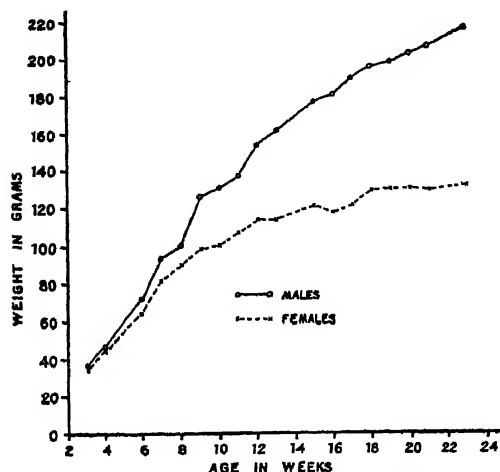


FIG. 1. Growth curve on Bengal gram diet.

occurred on the Bengal gram diet. These results thus prove that Bengal gram does not lack in any of the essential amino acids including threonine.

TABLE I

Age in months	Intake of nitrogen in mg.	Urine nitrogen in mg.	Fecal nitrogen in mg.	Balance in mg.
1	118.2	23.6	17.1	+77.5
2	145.7	65.2	30.6	+49.9
3	150.3	53.0	36.2	+61.1
4	159.6	72.1	31.2	+56.3
5	178.7	71.1	46.1	+61.5
6	173.7	100.5	52.0	+21.2

The presence of threonine in Bengal gram was confirmed by paper partition chromatography of a sulphuric acid hydrolysate of defatted Bengal gram. The method employed was essentially that of Dent<sup>6</sup> using phenol-water and collidine-water as the solvents. The chromatogram (Fig. 2) clearly shows the presence

of threonine in Bengal gram. The addition of a few 'γ' of threonine to the hydrolysate resulted in a chromatogram with an intense spot at the place marked '5' in Fig. II, thereby confirming that the original spot '5' was due to threonine.



FIG. 2. Chromatogram of Bengal Gram Hydrolysate.

1. Aspartic acid. 2. Glutamic acid. 3. Serine. 4. Glycine. 5. Threonine. 6. Alanine. 7. Lysine. 8. Arginine. 9. Histidine. 10. Proline. 11. Valine. 12. Methionine, Phenylalanine, Leucine and Isoleucine. 13. Tyrosine

Quantitative assessment of threonine by microbiological assay was carried out using *S. fecalis* R. (A.T.C.C. 8043) as the test organism. The general technique employed for the assay was similar to that described by Dunn, *et al.*<sup>7</sup> The threonine content of Bengal gram based on the results of three assays was found to give an average value of 8.10 g. per 100 g. of protein with a range of 7.95 to 8.22 g. The average recovery of threonine in parallel assays was 103.5 per cent.

The minimum level of threonine which is capable of supporting optimum growth in the weanling rat has been recently reported by Rose, *et al.*<sup>8</sup> to be 0.5 per cent. of the diet. Benditt, *et al.*<sup>9</sup> have established the amount of threonine essential for maintenance as 85 mg. per kilogram of body weight. Considering the amount of threonine present in Bengal gram, it is evident that the level is sufficient for growth and maintenance. This is in agreement with our observations on growth and N-balance of rats fed Bengal gram as the sole source of protein.

Nutrition Res. Lab, P. R. SRINIVASAN.  
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Coonoor,  
February 8, 1952.

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### SYNTHESIS OF SOME POTENTIAL ANTIMYCOBACTERIAL AGENTS

On the assumption that permeability constitutes the limiting factor in the potency of the known antimycobacterial agents such as *p*-aminosalicylic acid, streptomycin and sulfones,<sup>1</sup> a number of asymmetric diaminodiphenyl sulfones have been prepared with a view to include in the molecular architecture biologically stable groupings, that would confer upon the molecule an optimal fat water solubility ratio without materially interfering with its antibacterial activity. Such a molecule would be expected to penetrate to the site of action with greater ease.

The compounds have been so modelled as to carry a lipophylic alkyl chain at one of the nitrogen atoms, and a sugar, as the hydrophylic equilibrating moiety, at the other nitrogen. Galactose has been selected because it is known to be one of the few sugars that have comparatively little intercellular permeability impediments even though highly lipid insoluble.<sup>2</sup> The alkylamino linkage is expected to resist bio-cleavage, whereas galactose may split and the lipid soluble drug emerge at the site of infection with the requisite one free phenylamino group in the sulfone molecule.

TABLE I



RHN—  —SO <sub>2</sub> —  —NH—Galactose					
No.	R	Analysis % N		(α) <sub>D</sub> <sup>25°</sup> in MeOH	
		Required	Found		
1	Ethyl <sup>c</sup>	6.39	6.60	-20.0	±2
2	Propyl <sup>d</sup>	6.19	6.29	-18.0	"
3	<i>n</i> -Butyl <sup>c</sup>	6.00	5.50	-11.5	"
4	Isobutyl <sup>b</sup>	6.00	5.91	-15.0	"
5	<i>n</i> -Amyl <sup>b</sup>	5.80	5.83	-11.5	"
6	Isoamyl <sup>d</sup>	5.80	5.50	-11.5	"
7	<i>n</i> -Hexyl <sup>a</sup>	5.66	5.37	-11.5	"
8	Octyl <sup>a</sup>	5.35	5.00	-12.0	"
9	Lauryl <sup>a</sup>	4.85	4.67	-13.0	"

Table I indicates the various end-compounds synthesised and their requisite data. The *p*-alkylamino-*p*'-aminodiphenyl sulfones were prepared by a slight modification of the method used by Baker, Querry and Kadish<sup>3</sup> and these were converted into the corresponding galactosides by Kuhn and Strobel's procedure<sup>4</sup> using ammonium chloride as a catalyst. The galactosides do not have definite melting points but decompose over a range; the corresponding free amines, however, have very sharp melting points.

(a) Crystallised from methanol; (b) Crystallised from aqueous methanol; (c) Crystallised from water; (d) Could not be crystallised and were obtained as colourless amorphous powders.

Biological screening of these compounds and further syntheses along the above lines, as also of the corresponding sulfides, sulfoxides and thiosulfonates, are in progress. Preparative and biological data and other details will be published elsewhere

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NITYA ANAND.  
M. L. DHAR.

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### OCCURRENCE OF *LERNEENICUS* SP. ON *SCOMBER SCOMBER*, LAWSON'S BAY, WALTAIR

A SINGLE female was collected attached to *Scomber scomber*. The head and trunk of the parasite were deeply embedded in the body of the fish with only the bright red egg strings protruding behind. Dissection revealed the head lobes in actual contact with the vertebral column of the host. When removed the head was found to be yellowish with a slight blackish tint, the trunk of flesh colour and the egg strings bright red. The head is triangular with three posterior short conical lobes. The short neck merges with the trunk which is annulated and the egg strings which protrude behind are as long and of the same diameter as the trunk. The entire length of the body is 45 mm.

That it is *Lerneenicus* is shown by the fact that the head is triangular provided with three short knobs and is placed at right angles to

the thorax.<sup>2</sup> Specific identity could not be determined for want of more material.

My thanks are due to Prof. R. Gopala Aiyer for having kindly gone through this note.

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Andhra University,

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November 12, 1951.

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### A DILATOMETRIC STUDY OF THE SOYBEAN INHIBITORS

WITH the identification and isolation of proteolytic inhibiting substance present in soybeans by Ham, *et. al.*,<sup>1</sup> considerable interest has been evinced on the role of this inhibitor in protein nutrition.

In the experiments reported here, the course of digestion was followed by a three-bulbed dilatometer. The procedure employed was the same as recommended by Srinivasaya and Bhagavat.<sup>2</sup> The substrate (1% casein in sodium hydroxide-phosphate buffer, pH 8.0), enzyme (1% trypsin in the same buffer, proportion of substrate to enzyme being 20:1), and inhibitor\* (also at the same pH) were placed separately in the three bulbs of the dilatometer. When the solutions had attained the temperature of the thermostat (37° C.) as indicated by a constancy (within the normal permissible limits) of the fluid level in the capillary, the solutions were mixed.†

The level was recorded during the progress of digestion. A control was also run under identical conditions. Amino nitrogen release was recorded in both cases (Table I).

TABLE I  
Release of Amino Nitrogen

Serial No.	1	2	3	4	5	6	7	8	9	10
Time in minutes	0	15	30	45	60	90	120	150	180	240
Amino Nitrogen in control (mgm.)	0.5	5.8	7.5	9.7	10.6	12.4	13.7	14.6	15.5	16.0
Amino Nitrogen in experimental (mgm.)	0.9	5.9	6.0	5.7	5.0	5.9	6.9	6.0	7.0	8.6

\* Inhibitor was obtained by extracting raw soybeans with hydrochloric acid at pH 4.2. The extraneous protein present was removed by papain digestion.

The results indicate a fair amount of correlation between amino nitrogen released and the dilatometric readings (Fig. 1). While in the control series, there is a gradual and smooth breakdown as shown both by an uninterrupted drop in the toluene level (Fig. 1) and by a

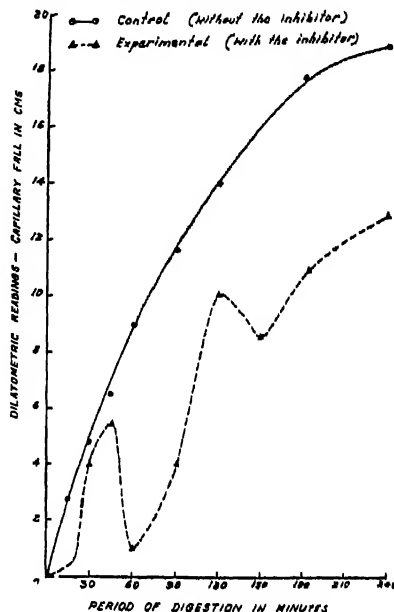


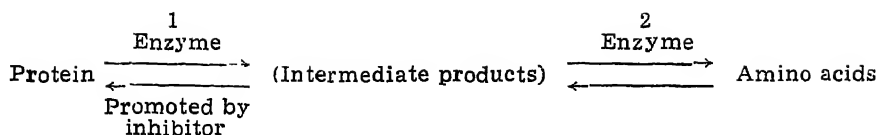
Fig. 1

steady increase in the amino nitrogen, in the experimental series toluene level has registered a fall and rise. The amino nitrogen released confirms the above. These data, therefore, suggest a disaggregation of the colloidal protein and aggregation of the breakdown products thereof under the influence of the inhibitor.

In addition to the above a number of other controls were also run under identical conditions—inactivated inhibitor (by heat treatment) + enzyme + substrate, inactivated enzyme + inhibitor + substrate, and inhibitor +

† The initial volume change, consequent on mixing the reactants was taken note of and necessary correction for this was applied.





enzyme only and due corrections for these were applied for obtaining the final results.

In other studies the inhibitor has been shown to be an anti-proteinase of trypsin having very little action on the peptidase activity of the enzyme (results under publication). The influence of the inhibitor after definite stages of pretryptic digestion was studied and these observations have shown that the percentage inhibition after 2 hrs. of predigestion is considerably higher than one hour predigestion. Under normal conditions, one should expect an increased digestion after two hour predigestion period as compared to one-hour predigestion period. These considerations therefore suggest that a certain concentration of peptides is necessary for the reverse reaction to proceed under the influence of the inhibitor. On the basis of this inhibitor action on predigested proteins, it is postulated that the inhibitor may act by facilitating an aggregation of the intermediate products—likely a resynthesis—of the protein by shifting the equilibrium backwards at Stage 1 as indicated above.

The detailed paper will be published elsewhere.

Our thanks are due to Dr. S. S. De and Dr. K. V. Giri for their keen interest and helpful suggestions in these investigations.

Dept. of Biochemistry, T. VISWANATHA.  
Ind. Inst. of Science, R. RAJAGOPALAN.  
Bangalore-3,  
January 29, 1952.

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# OCCURRENCE OF UNPAIRED OVARY IN *ONITIS DISTINCTUS* LANSB.

THE occurrence of paired ovaries is a common feature among insects. Amongst the Apterygota, in Thysanura, there are two ovaries each having five to seven ovarioles. Amongst the Pterygota, two ovaries occur in the primitive order like Orthoptera as well as in the higher orders like Hemiptera, Diptera and Coleoptera. The primitive number of ovarioles is probably never more than eight, this number being retained by *Periplaneta*, a representative of the most primitive Pterygote order, Orthoptera.

While dissecting *Onitis distinctus* Lansb. (Coleoptera-Scarabæidæ), the common dung roller, it was noticed that there was only one ovary having a single ovariole convoluted like the letter 'S'. It lies asymmetrically a little towards the left and extends from the first visible abdominal segment to the fourth. The average size of the ovariole is 14.8 mm. × 0.68 mm.

The occurrence of a single ovary with only one ovariole is a common feature in certain Aphididæ (Hemiptera) where it is a case of specialisation by reduction, but in Coleoptera it is a very unusual feature. Tanner<sup>1</sup> as a result of his study of the genitalia of sixty-seven Coleopteran families considered Scarabæidæ to be the most specialised family. The occurrence of single ovary with only one ovariole in *Onitis distinctus* Lansb. is another instance of specialisation in the family Scarabæidæ.

Zoology Department, P. D. SRIVASTAVA,  
University of Allahabad,  
Allahabad,  
January 10, 1952.

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# OCCURRENCE OF THE LIMBLESS LIZARD *BARKUDIA* ANNANDALE AT WALT AIR

THREE genera of limbless lizards, *Barkudia* Annandale and *Nessia* Grey of the family Scincidæ and the third *Ophisaurus* Daudin of the family Anguidæ, have so far been reported from India.<sup>1</sup> The genus and the type species *Barkudia insularis* was created by Annandale in 1917 for a form which he dug out from loose earth at the root of a banyan tree on the Barkuda Island in the Chilka lake.<sup>2</sup> A second specimen was collected in 1919 by Dr. F. H. Gravely from the same locality. Apart from these two specimens we are not aware of any other record of this species from India.

Limbless lizards belonging to the genus *Barkudia* Annandale are fairly common in the Andhra University Campus at Waltair and the immediate environs. The first specimen was collected by one of us in July, 1949. The animal lives buried in the sub-soil and they are more abundant in the surface layers immediately

after the rains. With the onset of dry weather they are comparatively rare, presumably because they burrow into deeper regions. From an examination of the stomach contents it is clear that they feed mostly on centipedes, insect larvæ, etc. The animal is an efficient burrower and it needs great care to dig them out entire.

Our collections from Waltair and its environs have convinced us that there are two distinct forms of the genus here, both differing from the type description for *Barkudia insularis* Annandale.

A detailed account of the systematics, bionomics, anatomy and life-history of the local forms are in progress and will be published in due course.

Department of Zoology, P. N. GANAPATI.  
Andhra University, K. KRISHNAN NAYAR.  
Waltair,  
February 21, 1952.

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#### ON THE TUBULAR OVA OF THE SOUTH INDIAN RODENT *BANDICOTA* *MALABARICA*

In polyovular mammals like the rabbit, rat, mouse, ferret, etc., the penetration of the ova by sperms results in the falling away of the follicle cells.<sup>1</sup> Other investigators like Yamane<sup>2</sup> have also observed this phenomenon in the rabbit and it has been experimentally shown by Gilchrist and Pincus in the rat.<sup>3</sup>

While investigating the early development and placentation of the South Indian rodent *Bandicota malabarica*, I happened to come across a few tubular ova which I believe are newly fertilised ones. They were obtained while sectioning the fallopian tubes of an animal which had well formed corpora lutea in its ovaries. As observed by Pincus and others the follicle cells have all become free from the ova and are scattered in the lumen of the fallopian tubes. The features of the cytoplasm and the well formed chromosomes situated eccentrically suggest that the ovum is a healthy one. According to Smith<sup>4</sup> the unfertilised tubular ovum of Opossum while remaining intact shows signs of degeneration such as a well vacuolised cytoplasm and clumped or fragmented chromatin. Similar degenerative features are not seen in the ovum under consideration and hence the ovum is believed to be healthy and fertilised.

Towards one pole of the ovum is a small conical elevation which in all probability is the fertilisation cone. By the side of the fertilisation cone is a short rod-like body situated well within the cytoplasm which seems to be the sperm head. The nucleus of the ovum has entered an advanced division stage. The polar view of the division spindle with distinct chromosomes can be seen in the photograph. This division stage is to be taken as the final maturation division because the sperm has only just entered the egg and is still far away from the egg nucleus. This is in accordance with the view of Arey<sup>5</sup> who states that the egg in mammals when ovulated has completed the first polar body whereas the second polar spindle is present in an arrested state. The second maturation division is gone through only during the preliminary events of fertilisation.

A fuller account of the early development and placentation of the species will be published elsewhere.

My thanks are due to Dr. P. N. Ganapati and to Professor R. Gopala Aiyar for help and encouragement.

Dept. of Zoology, K. KRISHNAN NAYAR.  
Andhra University,  
Waltair,  
February 21, 1952.

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#### PERSISTENT POLLEN TUBES IN *ANTIGONON LEPTOPUS* HOOK ET ARN

USUALLY, the pollen tubes, in the ovules of angiosperms collapse and vanish soon after fertilization. However, a few departures from this usual behaviour are on record, namely, *Galinsoga ciliata*, *Ulmus americana*, *Hicoria pecun*,<sup>2</sup> *Ottelia alismoides*, *Hydrilla verticillata*,<sup>3</sup> *Oxybaphus nyctagineus*<sup>1</sup> and in Malvaceae.<sup>4</sup>

This note puts on record the occurrence of persistent pollen tubes in *Antigonon leptopus*, a member of the family Polygonaceae. The pollen tubes have been found to persist in the micropylar part of the ovules up to an advanced stage of the development of the embryo in this plant. The pollen tube is unbranched and about 8  $\mu$  in diameter. It stains uniformly (red with safranin) and shows no recognisable cytoplasmic contents. Therefore, it looks improb-

able that these perform any haustorial function in this plant.

I wish to express my sincere thanks to Prof. J. Venkateswarlu for his guidance and to Mr. C. Venkatarao for his suggestions.

Dept. of Botany, B. S. SRIV RAO.  
Andhra University,  
Waltair,  
February 8, 1952.

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# EMBRYOLOGY OF SABIACEAE

SABIACEAE includes four genera of which *Meliosma* is the largest with nearly sixty species. Very little is known about its embryology, except for some very brief notes by Mauritzon<sup>1</sup> on some embryological features of *Meliosma Arnottiana*, *M. obtusifolia*, *M. pyriantha*, *M. monophylla*, *M. myriantha*, *M. tenuis*, *M. tsangtakii* and *Sabia javanica*. Preserved and pressed materials of these were studied by him up to the time of fertilisation. In the present note some observations on three species of *Meliosma* are recorded some of which have not been mentioned by Mauritzon.<sup>1</sup>

The young anther wall shows four layers external to the tapetum. The endothecium develops fibrillar thickenings. The tapetum is of the glandular type and its cells are binucleate. The tapetal nuclei show a tendency to secondary fusion and subsequent division. Sixteen bivalents were counted during the first division of the microspore mother cell of *Meliosma Wightii* (Fig. 1). The pollen grain is two-celled at the shedding stage. In *Meliosma Arnottiana* the generative cell is elongated (Fig. 2) but in *M. Wightii* it is lenticular.

The superior ovary is bilocular and each locule encloses two pendulous unitegmic ovules (Fig. 3). Clustered crystals are present in the cells of the ovary wall. The integument does not organise a micropyle (Figs. 5 & 7). The development of the female gametophyte is of the Polygonum type (Figs. 4 & 5). The synergids in *Meliosma Arnottiana* are hooked, but simple in *M. Wightii* and *M. simplicifolia*. The egg is situated between them. The secondary nucleus is in the diverticulum near the chalazal region of the embryo sac (Fig. 5). The antipodals are organised as definite cells and degenerate early; but in *Meliosma Arnottiana* they persist for some time during early post-

fertilisation stages. In *Meliosma Arnottiana* cases of supernumerary pollen tubes entering the mature embryo sac were observed (Fig. 6).

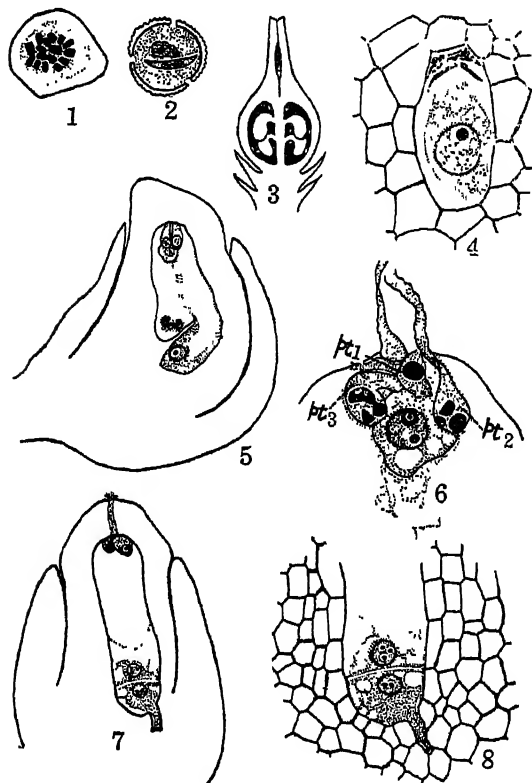


FIG. 1. Polar view of dividing pollen mother cell showing sixteen bivalents  $\times 450$ . FIG. 2. Mature pollen grain  $\times 450$ . FIG. 3. L. S. ovary to show the arrangement of ovules. FIG. 4. Tetrad of megaspores  $\times 450$ . FIG. 5. L. S. ovule showing mature embryo sac with the diverticulum  $\times 135$ . FIG. 6. Supernumerary pollen tubes near the fertilised egg  $\times 450$ . FIG. 7. The three pollen tubes. FIG. 7. The upper and lower chambers formed after the transverse division of primary endosperm nucleus  $\times 135$ . FIG. 8. Same enlarged to show the process developed from the lower chamber  $\times 225$ .

In all the species under investigation, the development of a diverticulum from the embryo sac is a characteristic feature. This diverticulum which is formed during the development of embryo sac, grows always towards the funiculus. The secondary nucleus is now present in the diverticulum and triple fusion occurs here. The primary endosperm nucleus, in the diverticulum, divides by a transverse wall resulting in the formation of two chambers. The nucleus in the lower chamber divides and this chamber remains binucleate throughout. Also, one or more haustorial processes develop from this lower chamber (Figs. 7 & 8).

The mature embryo is dicotyledonous and the hypocotyledonary region is twisted. The fruit is a drupe enclosing inside an albuminous seed. The remaining seeds degenerate. In *Meliosma simplicifolia*, degeneration of seeds is found to be due to the entry of an insect larva at about the time of anthesis.

My thanks are due to Prof. L. N. Rao, Dr. K. Subramanyam and Mr. M. A. Rau for kind encouragement and guidance.

Dept. of Botany, M. V. S. RAJU.  
Central College,  
Bangalore-1,  
March 12, 1952.

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#### THE EFFECT OF A PRELIMINARY PERIOD OF DARKNESS ON THE PERCENTAGE GERMINATION OF THE SEEDS OF *ANISOCHILUS ERIOCEPHALUS* BENTH.

SEEDS collected in November, 1947, were used in experiments conducted in April and May, 1948, both in light and in dark. By 'light' is meant the diffuse daylight received inside the laboratory through the windows. The 'light period' thus included about 10-11 hours of darkness at night. 'Dark period', on the contrary, indicates total darkness for all the 24 hours.

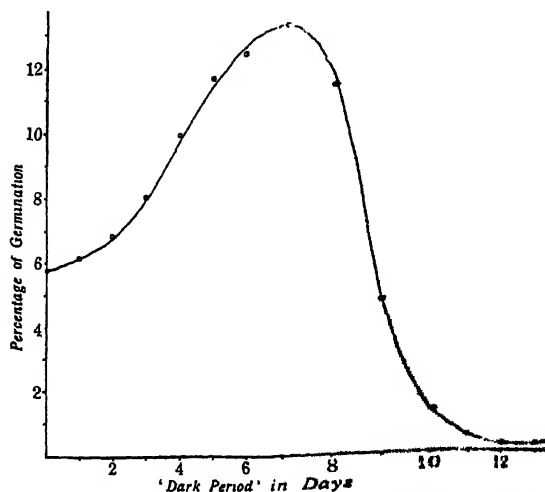
Experiments were carried out with 15 sets of seeds, each set consisting of a batch of 500 seeds placed in between moist pieces of blotting paper. One set was kept in light and the remaining 14 in dark. Each day one of these latter sets was removed to light and the day-to-day germination was noted in all the 15 sets. The whole experiment was duplicated and the mean of the two is shown in the graph (Fig. 1).

It is seen that a period of preliminary continued darkness has a definite and very marked effect upon the percentage of germination which increases first with the increase in this 'dark period', reaches a maximum of 13.4 per cent. for 7 days and then falls sharply almost to zero on the 12th day.

Other useful observations made were:

(1) The maximum germination for a particular day was observed on the 4th day of receiving light; (2) After remaining for 6-9 days in dark, about 0.3 per cent. of the seeds could germinate after only one day's exposure to light; (3) After removal of the seeds to light the germination stopped completely from the 11th day of the 'dark period'; and (4) The germination in dark was almost constant

(about 0.3 per cent.) and was observed usually on the 6th day.



It may be recalled that a number of authors have noted the varied influence of light on the germination of seeds. Of these the case of *Lythrum salicaria* studied by Lehmann<sup>1</sup> (quoted in Stiles, *Plant Physiology*<sup>2</sup>) is most striking. He found that an exposure of the seeds previously kept in dark to a light intensity of 730 metre candles for just 0.1 second increased the germination from 7 per cent. to 50 per cent. A similar case has been noted above for *Anisochilus eriocephalus* where the percentage of germination in dark, irrespective of an increase in the period, remains constant but an exposure to light for even a short period, after a particular duration of preliminary darkness, is sufficient to bring about an appreciable increase in the percentage. The interesting new observation is that a further increase can be obtained when the seeds are subjected to a preliminary period of darkness. Hence, the influence of light on germination must be considered in relation to other factors.

It gives me great pleasure to thank Dr. R. Misra of the University of Saugar where this work was carried out, for his valuable help and guidance.

Department of Botany,  
Birla College,  
Pilani,  
Rajasthan,  
April 10, 1951.

T. S. BAKSHI.

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## REVIEWS

**Radiochemical Studies: the Fission Products.** Books 1, 2 & 3. Edited by Charles D. Coryell and Nathan Sugarman. National Nuclear Energy Series Manhattan Project Technical Section, Division IV—Plutonium Project Record—Vol. 9. (Published by McGraw Hill Book Co. Inc, New York), 1951. Pp. 2086. Price \$18.50 per set.

This is a record of the research work accomplished under project contracts on the fission products during the war years. A total of 336 research papers make up the complete set made into three volumes for the sake of convenience.

Book I consists of four parts dealing with: (i) Counting Techniques—11 papers; (ii) Chemical Studies at Tracer Levels—12 papers; (iii) Remote Control Techniques—10 papers; and (iv) Studies of the Fission Process—19 papers.

Books II and III contain 173 research papers dealing with (v) the 'Radioactivity of Fission Products', of which 147 dealing with the radioactivity of elements ranging from Zinc ( $Z=30$ ) to Europium ( $Z=63$ ) form Book 2. The remaining 26 papers on 'Fission Yields' of  $U^{235}$ ,  $U^{238}$ ,  $Pu^{239}$  irradiated with fast and slow neutrons forming Part (v) are continued in Book 3. Part (vi) gives the 'Radiochemistry of Fission Product Elements'—85 papers, Part (vii) the 'Special Studies of Gaseous Fission Products'—7 papers and Part (viii) the 'Radiochemical Studies of Other Activities'—19 papers.

The set thus gives not only the radiochemistry of the fission products, as the name signifies, but full details of the instrumentation necessary in the measurements of activities and in handling, by remote control, materials with considerable activities as they come out of the reactor. The methods of separation and purification of compounds of elements about which little was known upto 1940, have been described in great details in these papers. The methods will be found useful to the analytical chemist whether he is dealing with radio-active or inactive mixtures. To the nuclear chemist, as also to the nuclear physicist, they will be of very considerable value.

A certain amount of repetition is observed. Also data given in one paper sometimes is found to contradict that given in another. This is perhaps inevitable in a work of this nature. Far from detracting from the value of the

work, it gives a historical background of the development of the projects and also indicates the necessity of this overlapping in the interests of maintaining secrecy. The footnotes indicate the data which are dependable. A small summary given at the beginning of each chapter adds to the usefulness of the books.

The introductory chapter gives the terminology adopted in the text. The book contains numerous figures, plates and circuit diagrams which will enable the reader in the field not only to understand the paper but to set up the equipment in one's own laboratory. The appendices give the 'Fission Products Decay Chains', 'Fission Yield' and 'Nuclides Formed in Thermal Fission'. A full author and general index complete the set.

The books will be a valuable addition to any library and an indispensable set for a nuclear chemist or physicist.

JAGDISH SHANKAR.

**Further Laboratory and Workshop Notes.** Compiled and edited by Ruth Lang for the Institute of Physics, London. (Edward Arnold & Co.), 1951. Pp. 290. Price 28 sh.

In the *Journal of Scientific Instruments* published by the Institute of Physics, London, there is a section on Laboratory and Workshop Notes. This was introduced in the year 1930 so as to serve as a medium through which devices, special methods, etc., evolved in one Laboratory or Workshop could be passed on to other workers. Most of the important notes which appeared in this section of the *Journal of Scientific Instruments* before the year 1946 were reprinted in the form of a book entitled *Laboratory and Workshop Notes*. This was compiled and edited by Miss Lang on behalf of the Institute of Physics. This publication was very well received by the scientific world. The same author has now made a second selection of the notes from 1946 onwards with the addition of several from the earlier years for which there was no room in the first volume.

In the volume under review, the notes have not been reprinted as such, introductory paragraphs and acknowledgments having been omitted. Some of the notes have been condensed and the trade names of products generally

omitted. The authors of the respective notes have in many cases brought the information contained in their notes up-to-date. There are on the whole one hundred and twenty-four notes which have been classified under seven sections: (1) graphs and drawings, (2) optical devices and techniques, (3) devices for liquids and gases, (4) heat, thermometry and furnaces, (5) laboratory and workshop tools, processes and devices, (6) vacuum and pressure techniques and devices, and (7) electrical devices and ancillary equipment and techniques. The book is also provided with a subject-index which will be very useful to the reader.

The presentation of the Laboratory and Workshop Notes in a collective form makes them readily available to the workers in the laboratory. The book will be found to be indispensable to those who are interested in preparing some gadget or other for their experimental problems. It should therefore find a place in every physical research laboratory.

R. S. K.

**Survey of Modern Electronics.** By P. G. Andres. Published by John Wiley & Sons, Inc., New York, (Chapman & Hall, Ltd., London), Indian Agents. Asia Publishing House, 17, Gunbow Street, Bombay-1. Pp. x + 522. Price \$ 5.75.

This book is a welcome addition to the available literature on the subject. It is divided into eleven chapters. Commencing with the basic ideas of electron emission, the theory of the diode, triode, multi-electrode tubes, cathode-ray oscilloscope, klystron, magnetron, thyatron, etc., are developed. The electron microscope, the mass spectrometer, the cyclotron, the betatron, etc., also come up for elementary treatment. Photosensitive tubes and devices are also adequately dealt with. The last four chapters are devoted to electronics in instrumentation, electronics in communication, electronic controls and electronics in heating. The book is thus self-contained and complete in itself as providing a complete review of the present position of electronics.

The treatment is everywhere clear and correct and the book is most readable. As matters stand to-day, a course in electronics is very necessary for civil, mechanical, electrical, chemical and metallurgical engineers, physicists and chemists. To students taking all these courses in the Universities, this book can be most heartily recommended. Students of communication will find this book very useful in

the preliminary stages as a most readable introduction. The book should find a place in every engineering school or college library.

The printing and get-up of the book are of the high standard we have come to expect of the publishers. The photographs are well printed. The diagrams are well drawn and extremely well reproduced. The price is, therefore, most reasonable.

S. V. CHANDRASEKHAR AIYA.

**Theory and Design of Valve Oscillators.** By H. A. Thomas. Second Edition. (Published by Chapman & Hall, London), 1951. Pp. xvi + 317. Price 36 sh. nett.

This book is the seventh volume of the well-known monographs on electrical engineering edited by H. P. Young. The author has made important contributions in the field and the book has the stamp of authority. The second edition is a vast improvement over the first and incorporates all the major developments in the field. The first six chapters are devoted to LC oscillators. The different types, the question of amplitude, wave form, efficiency frequency stability, frequency stabilisation, etc., all come up for detailed treatment. RC crystals, U.H.F., Klystron and Magnetron oscillators are considered in separate chapters. Chapters on the klystron and magnetron oscillators are most readable. There is a very valuable bibliography at the end containing references to 172 well-chosen and valuable papers.

The printing and get-up of the book are good. The book is indispensable to Honours students in Communication Engineering, to research workers interested in the field and to advanced students in Physics specialising in Wireless.

The reviewer would have appreciated the inclusion of a chapter on RC oscillators used for pulse and saw tooth generation, as that would have made the book complete in itself. It is to be hoped that this omission will be made good in a subsequent edition.

S. V. CHANDRASEKHAR AIYA.

**Power System Analysis.** By J. R. Mortlock and M. W. Humphrey Davies (Published by Chapman & Hall), 1952, Pp. 384. Price 45 sh. net.

A post-graduate vacation course on "Power System Analysis" was held in 1949 at the Imperial College, London, with the primary object of exchanging information between power system engineers, research workers and teach-

ers concerning current difficulties and recent advances in the application of steady state network theory to the problems encountered in power system engineering. The book under review is based upon notes circulated for the course, and the discussions which followed. The book is intended primarily for those who already have some experience of power system work.

The book opens with a chapter on A.C. circuits followed by solution of simple networks and method of symmetrical components. Chapters IV and V deal with the characteristics of underground cables and characteristics of overhead lines respectively. Chapters VI and VII are devoted to equivalent circuits of transformers and synchronous machines, while Chapter VIII deals with characteristics of loads. A chapter has also been included on stability of A.C. power systems. Chapter X deals with control of watts, vars and voltage and Chapter XI on systematic computation. Two chapters have also been included on the application of matrix algebra to network problems. The book concludes with a chapter on Network Analysers which are so invaluable in present-day power system studies and a chapter on power system design.

In view of the wide range of subjects covered, the book can best be treated as a good introduction to specialised publications, to which numerous references have been made in the text. The printing and get-up of the book are excellent and leave little to be desired. Unfortunately, the present trend in price of technical publications seems to be still on the rise and the rather high cost of the book may go against an average buyer.

H. N. RAMACHANDRA RAO.

**Indian Vegetable Oils as Fuels for Diesel Engines.** By J. S. Aggarwal, H. D. Chowdhury, S. N. Mukherji and L. C. Verman. (C.S.I.R., New Delhi), 1952. Pp. 31. Price Re. 1.

The Bulletin is a well-written general review, on the possibilities of the utilisation of Indian Vegetable Oils as Diesel Fuels and also includes the results of some experiments conducted by the authors. The survey of previous work at the beginning and in the Appendix give a good summary of the work previously done on the subject. The *General Requirements of Diesel Fuels* is written in very easy language and we believe is intended chiefly for non-technical people. The review of the tests conducted by the authors includes a table on the

properties of the various oils used by the authors, and also summarises the suitability of the oils as diesel fuels but, as the authors themselves have stated, these results are by no means conclusive. Thus, in spite of the discouraging results obtained by the authors while using castor oil, it may still be possible to use it in diesel engines with suitable modifications, say, either by pre-heating the fuel or increasing the injection pressure, etc. The authors have not included a schematic diagram of the shape of the combustion chamber, the position of the injector nozzle, etc., so that factors which possibly influence the process of combustion remain undefined. After studying the Bulletin, one agrees with the authors that more work still remains to be done on this important problem.

H. A. HAVEMANN.

**Chemistry of Carbon Compounds.** (Modern Comprehensive Treatise). Edited by E. H. Rodd. Vol. I, Part A. General Introduction and Aliphatic Compounds (Elsevier Publishing Co., London and New York). Pp. 777.

The present volume is part of a comprehensive treatise in Organic Chemistry written by a team of distinguished chemists and is intended to fill a place intermediate between the great encyclopædias like 'Beilstein' and instructional works like 'Karrer'. It is a successor to Rich-ter's *Organic Chemistry* and the original framework and classification are maintained. The subject-matter is quite up to date and contains all the advances of recent years.

Part A of Volume I includes a long introductory chapter having special sections on important general aspects of organic chemistry. These consist of a number of essays dealing with the physical properties of carbon compounds, and important aspects of physical chemistry by writers who have made special study of these. Particular emphasis is given to stereochemistry and reaction mechanism. Under analytical chemistry are described micro and semi-micro-methods. The next eleven chapters bring the subject upto dicarbonyl compounds. Obviously there will be one more part in Vol. I. No clear indications are given of the total number of parts that will come out, though it is stated there will be five volumes.

In a work of this nature written by many authors some unevenness of treatment can be expected. This is conspicuously absent in the present volume. There is no doubt that it will prove to be a very valuable companion to all

organic chemists providing authoritative information. The value of the work is further enhanced by references given to original sources, to reviews and to special articles.

T. R. SESHADRI.

**The Chemistry and Technology of Food and Food Products.** Vol. II. Edited by Morris B. Jacobs (Interscience Publishers, Inc., New York, London), 1951. Pp. xxvi + 833-1,770. Price \$ 15.00.

In this thoroughly revised and unified collaborative effort, experts in individual food fields have included the latest knowledge that has accumulated since the publication of the first edition in 1945. This volume, comprising Part Four of the series, contains a mine of useful information on the descriptive aspects of particular food groups. Some account has also been given of their history, statistics, definitions, standards (U.S.), composition and chemistry. A balance has been maintained throughout the book between the sciences of agriculture, botany, food chemistry, biochemistry, nutrition and food microbiology. The treatment is in general concise, but certain important aspects like the curing of meat, the factors in influencing quality in bread, storage changes of individual food products and the conditions under which spoilage can be minimised in them, have been dealt with in good detail. The statistical data are often representative only of American food products. This is so especially with the chapter on "Poultry and Eggs", which has obviously been written purely from the point of view of this American industry, which from humble beginnings has now become a billion dollar industry. In practically every chapter the authors have tried to enumerate both edible and inedible by-products obtainable from various food groups. Tropical food products like millets among the cereals and mango and jackfruit among the fruits do not find mention in this otherwise authoritative compilation. It is also rather surprising that there has been no data reported on the vitamin B<sub>12</sub> content of milk and other products.

In the years to come, biochemists and food experts will doubtless have to explore many food fields as yet untouched. Nevertheless, the valuable collection of material on food and food products presented in this series should prove to be of immense advantage to food technologists of both professional and practical training.

A. SREENIVASAN.

**The Chemistry and Technology of Food and Food Products.** Vol. III. Edited by Morris B. Jacobs (Interscience Publishers, Inc., New York-London), 1951. Pp. xxx + 1,771-2,580. Price \$ 15.00.

The support received by the processed food industry from the army during the last World War resulted in such tremendous development in methods of manufacture, instrumentation, materials of construction, packaging and quality control that a complete revision of Vol. II of the last edition (1945) has now been necessitated.

The volume is divided into two parts—Part Five deals with the principal methods of food preservation and includes chapters on preservation by canning, dehydration, temperature control, and by use of micro-organisms; chemical preservatives and packaging are also discussed. The treatment is again general but individual aspects such as factors influencing processing of canned foods, role of salt in preservation and freezing of foods receive adequate attention.

Part Six is devoted to methods of production of individual food products. The chapters on "Sugars and Syrups" and "Production of Non-Alcoholic Beverages" are from new contributors. The importance of enzymes in the production of food products has caused the inclusion of a chapter on this subject. Another notable addition is the chapter on "Manufacture of Chewing Gums". Detailed description of production methods as well as flow diagrams and photographs of latest equipment are presented throughout. Due emphasis is given to materials of construction and to the nutritive value of the products.

A feature of the chapter on "Oils and Fats" is the inclusion of a description of modern semi-continuous deodorizing apparatus and of rotator fat pasteurizing apparatus. The chapter on fruit juices includes an excellent account of concentration by single effect force circulation evaporation and by means of a recompression evaporation system.

Part Five ends with a chapter on packaging which often makes or mars the fortunes of a food product in the market, while Part VI also ends appropriately with a chapter on "Industrial Waters" used for various purposes in the manufacture of food products.

This set of 3 volumes has, to date, been the ablest and most complete account yet available on the subject. The contributors have succeeded admirably in integrating food science with food production and processing procedures.



Attention has been focussed on the needs of the practical man and the scientist alike. As such, these volumes should prove invaluable to students of food technology and to personnel engaged in food industry.

A. SREENIVASAN.

**A Text Book of General Physiology.** By Hugh Davson. (J. A. Churchill, Ltd., London), 1951. Pp. xii + 659. Price 45 sh.

The aim of the book is to make a comprehensive and critical survey of the results of modern research in the field of general physiology. Although Dr. Davson has undertaken the formidable task of covering a very wide field, yet he has succeeded in giving a clear, comprehensive and intelligent account of the principles of general physiology in terms of concepts familiar in the basic sciences of physics and chemistry.

The text is divided into six parts. After discussing the structural basis of living matter, the author deals with the transformation of energy in living systems and transport of water and solutes, where he gives an interesting account of permeability and structure of plasma membrane, of absorption from intestine and secretion of gastric acid. The sections on muscles, nerves and discussion on light and its effect on and its emission by the organism are very illuminating.

The excellence of Dr. Davson's book is all round and hence it is difficult to choose any one section for special praise. The whole book is full of valuable information. The graphs and figures are well-chosen and the list of reference is exhaustive. The book will certainly stimulate much interest amongst students of physiology and the related sciences of botany, zoology and medicine.

N. N. DE.

#### Books Received

**Structural Chemistry of Inorganic Compounds,** Vol. II. By W. Huckel. (M/s. Elsevier Publishing Co.), 1951. Pp. x + 441-1,094. Price 90 sh.

**The Magnetron.** By R. Latham, A. H. King and L. Rushforth. (M/s. Chapman & Hall), 1952. Pp. ix + 142. Price 18 sh.

**Soil Chemistry.** By M. Y. Shawarbi. (M/s. Chapman & Hall), 1952. Pp. x + 420. Price 32 sh.

**Medicinal Chemistry,** Vol. II. By Alfred Burger. (Interscience Publishers), 1951. Pp. xv + 579-1,084. Price \$10.00.

**Modern Trends in Physiology and Biochemistry.** Edited by E. S. Gusman Barron. (M/s. Academic Press), 1952. Pp. xxii + 538. Price \$8.50.

**The Action of Hormones in Plants and Invertebrates.** Edited by K. V. Timann. (M/s. Academic Press), 1952. Pp. viii + 228. Price \$5.80.

**The Dynamics of Faulting and Dyke Formation with Applications to Britain.** (2nd Edition). By E. M. Anderson. (M/s. Oliver & Boyd), 1951. Pp. x + 206. Price 22 sh. 6 d.

**Sugar Industry in India and Abroad.** By P. C. Goswami, Gauhati, 1951. Pp. 72. Price Rs. 3.  
**Plane and Spherical Trigonometry,** 3rd Edn. By Lyman M. Kelles, Willis F. Kern and James R. Bland. (M/s. McGraw Hill), 1951. Pp. xi + 290.

**Astrophysics.** Edited by J. A. Hynek. (M/s. McGraw Hill Book Inc.), 1951. Pp. xii + 703.  
**Bioluminescence.** By E. Newton Harvey (M/s. Academic Press), 1952. Pp. xvii + 649. Price \$13.00.

**Thiophene and Its Derivatives.** By Howard D. Hartough. (Interscience Publishers), 1952. Pp. xvii + 533. Price \$16.50 (Sub. Price \$15.00).

**The Enzymes, Vol. II, Part II. Chemistry and Mechanism of Action.** Edited by Karl Myrback and James B. Sumner. (M/s. Academic Press), 1952. Pp. xi + 791-1,440. Price \$14.00.

**The Chemistry of Lignin.** By Friedrich Emil Brauns. (M/s. Academic Press), 1952. Pp. xv + 808.

**Advances in Carbohydrate Chemistry, Vol. VI** Edited by Claude S. Hudson and Sidney M. Cantor. (M/s. Academic Press), 1951. Pp. xi + 441. Price \$8.50.

**The Chemistry of Synthetic Dyes, Vol. I.** By K. Venkataraman. (M/s. Academic Press), 1952. Pp. xvi + 704. Price \$14.50.

**An Introduction to the Embryology of Angiosperms,** 1st Edn. By P. Maheswari. (M/s. McGraw Hill Book Co.), 1950. Pp. x + 435. Price 52 sh. or \$6.00.

**Flora of the British Isles.** By A. R. Clapham, T. G. Tutin and E. F. Warburg. (Cambridge University Press), 1952. Pp. li + 1,591. Price 50 sh. net.

**Name This Insect.** By Eric Fitch Daglish. (M/s. Macmillan & Co.), 1952. Pp. xxvi + 294. Price 15 sh. net.

**Radio Astronomy.** By Bernard Lovell and J. A. Clegg. (M/s. Chapman & Hall), 1952. Pp. 238. Price 16 sh.

## SCIENCE NOTES AND NEWS

Exposed Inferior Ovaries in *Cucurbitaceae*

Prof. K. N. Kaul, Herbarium, National Botanical Gardens, Lucknow, writes as follows:

Following the observations<sup>1</sup> on half-inferior ovary in a variety of Kharbooza, *Cucumis melo*, an intensive search was made to find the behaviour of the ovary in other cucurbits. In the following cultivated species it was found that the ovary shows a tendency to expose itself habitually: *Luffa acutangula* Roxb., *Lagenaria vulgaris*, Ser. Var. with fruits broader at the upper end. In a very exceptional case an exposed ovary was also found in a late variety of *Cucumis melo* L. var. *momordica* (Phut).

1. *Chur. Sci.*, 1951, 20, 303.

*Cucurbita pepo* in Experimental Tuberculosis

*Cucurbita pepo* (Synonym: *Kooshmunda*, *Boodigumbala*) is widely recommended in indigenous medicine both as curative for the disease and restorative during convalescence of tubercular patients. The studies of M. Sirsi, P. R. J. Gangadharam and R. Rama Rao, Indian Institute of Science, have shown that water and acetone extracts of the fruit pulp inhibit the growth of virulent strains of *Myco. tuberculosis in vitro*. The water extract also retards the progress of the disease in experimental tuberculosis of mice, thus lending experimental support for the use of this well-known Ayurvedic remedy.

Occurrence of *Codium* on the Coromandel Coast

Shri T. Sreeramulu, Department of Botany, Andhra University, writes as follows:

Recently the writer collected a few specimens of a species of *Codium* which answers to the description of *C. Iyengarii* Borges., from Waltair Coast. These plants were found growing attached to rocks in the littoral region together with other algal members. The occurrence of this genus on the East Coast north of Krusadai Islands is not known so far and the object of this note is to put the same on record on the Coromandel Coast of India.

The author's thanks are due to Prof. J. Venkateswarlu for kind encouragement.

## Research Degree Awards

On the recommendation of a Board of Examiners consisting of Dr. B. Prasad, Dr. N. R. Dhar and Dr. B. N. Ghosh, the Ph.D. Degree of the Utkal University was conferred on Sri. Sukumar Aditya for his thesis on "Studies on the Behaviour of Some Bi-Univalent Salts in Aqueous Solution".

The University of Poona has awarded the degree of Doctor of Philosophy in Chemistry to Sri. M. G. Marathe for his thesis entitled "Structure and Constitution of Flavones and Flavonals".

## Institution of Chemists (India) Silver Jubilee

The Institution of Chemists (India) proposes to celebrate its *Silver Jubilee* in December, 1952, with Sir J. C. Ghosh, Director, Indian Institute of Technology, Kharagpur, as Chairman, U. P. Basu, Director, Bengal Immunity Research Institute, Calcutta, as Secretary (Publication), and R. N. Chakaravarti, Professor of Chemistry, School of Tropical Medicine, Calcutta, as Secretary (Management). A brochure is to be published to commemorate the Society's services to the profession, industry and the State during the period.

The brochure is expected to contain contributions from several distinguished Indian Chemists.

## I. G. Farben Central Laboratory Index

A micro-film photographic facsimile of the I. G. Farben Central Laboratory Index is available at the D.S.I.R. Technical Information and Documents Unit, Lacon House, Theobalds Road, W.C.1. The Index can be inspected by appointment and no charge is made for inspection. Photo copies of entries may be ordered and purchased.

Most of the entries refer to dye-stuff, but the index also covers resins, plastics, detergents, wetting agents, water-proofing and emulsifying agents, textile assistants, rubber accelerators, cellulose esters, synthetic rubber, oil additives, tannins, insecticides, solvents, pharmaceutical products and other commodities.

## New Drugs for Tuberculosis

Three isomers of niacin have been produced independently by two well-known pharmaceu-

al firms, Hoffman-La Roche Inc. and E. R. uibb & Sons, for fighting tuberculosis. They are isonicotinic acid hydrazine, 1-isotiny-2-isopropyl hydrazine and a flucosyl derivative of it. Of the three, the first has proved the most effective.

Tuberculosis of the throat, the tongue, the estinal tract and other tissues have responded to the treatment, and beneficial results have been reported in the most persistent form of the disease, bone tuberculosis, and also in meningi-

The use of the drugs is still in the experimental stage and further tests have to be made before they are put on the market.

#### UNESCO Scheme for Safe Transit of Delicate Scientific Instruments

The scheme is designed to prevent delicate instruments from being delayed or damaged during customs inspection. The arrangement proposed by UNESCO provides for inspection of such instruments to be made in the laboratories themselves, under competent supervision, rather than in customs posts at national frontiers or terminals. Each participating Government would name the laboratory or laboratories in its country to which it wished to extend the privileges of the scheme.

The actual procedure might vary from country to country, but UNESCO will keep a register of laboratories designated by governments and would periodically send to interested countries a list of these laboratories, as well as details of operation. Information reaching UNESCO by June 1, 1952, will be included in its first circular.

#### Upper-8-Quinolate for Weather-proofing

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#### Krilium

Krilium is described as a synthetic substitute for the natural humus which is normally plen-

tiful in virgin, fertile soils, but scarce in silt and clay soils of poor structure. The chemical is a polyelectrolyte and carries negative electrical charges which react with positive charges in soil minerals to give the soil its proper structure. One lb of krilium has essentially the same effect on soil as 200 lb. of peat moss or 500 lb. of commercial compost.

It is believed that krilium brings about immediate improvement of heavy soils that pack down when wet, form hard clods when cultivated, and crust over during dry periods. If these claims prove justified, farmers throughout the world may eventually use krilium or something similar to it to reclaim barren clay fields once considered unfit for cultivation.

#### Symposium on Paints and Varnishes

A symposium on Paints and Varnishes was held at the National Chemical Laboratory, on March 6th and 7th, 1952. More than forty research and technical papers on raw materials, manufacture, testing and special purposes, coatings were presented in the two-day session. Special discussions on the subjects of "Accelerated Weathering" and "Cashewnut Shell Liquid" were also arranged. The Director, National Chemical Laboratory, inaugurated the symposium.

#### Ferroxdure

Ferroxdure, a new magnetic material announced by the Philips Research Laboratories (Holland), is a ceramic product, produced like china-ware by sintering or firing. Nickel and cobalt, which are nearly always present in magnet steel, are not necessary for its formation, it being only an oxide and not a metal. Its magnetic properties are considered so favourable that it is quite likely to replace the magnet steel at present used for permanent magnets.

#### CORRECTION

In the note on "An Antidiabetic Principle from *Rivea cuneata* (Wright)" (Vol. 21, No. 3, p. 69, Col 1, para 5), the sentence beginning "The glycoside. . . ." should read as follows:

"The glycoside was given orally to rats in daily doses of 5 mg. dissolved in water, 8 days after they received sub-cutaneous injections of 200 mg./kg. of alloxan"

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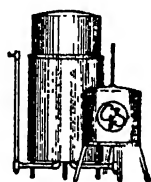
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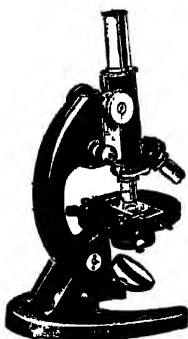


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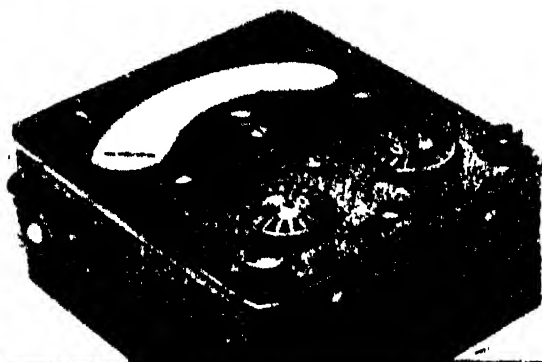
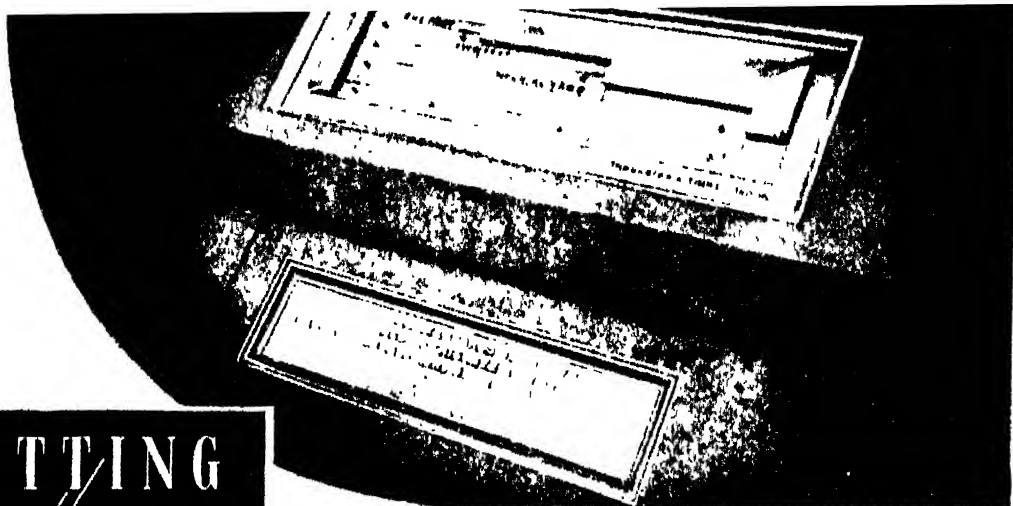
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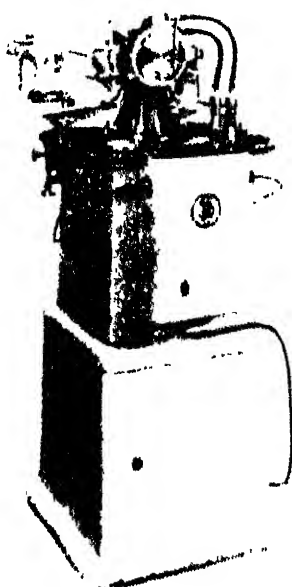
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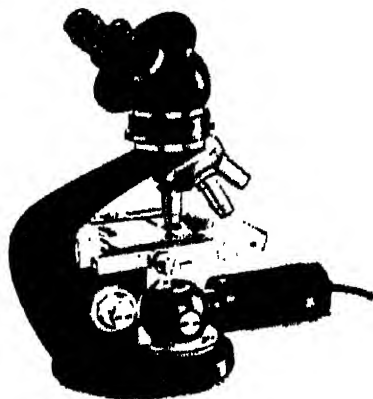
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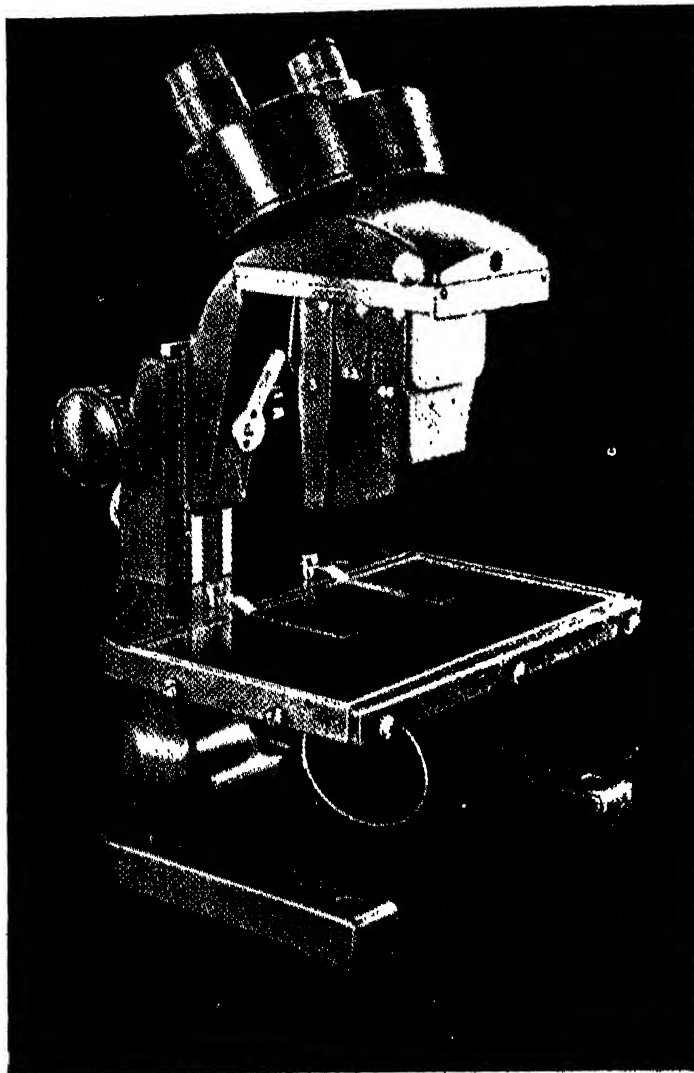
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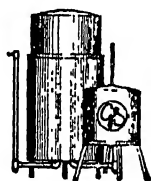
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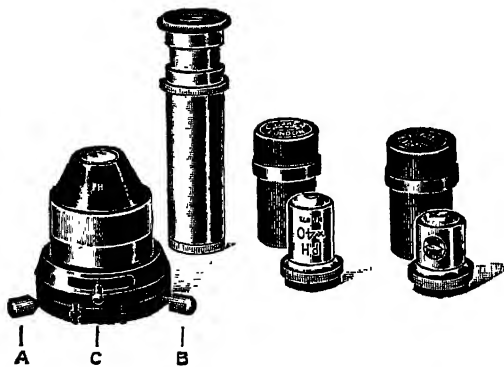
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# Current Science



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## SCIENTIFIC RESEARCH AND INDUSTRIAL DEVELOPMENT IN AID OF DEFENCE\*

IN recent years, the connection between defence and practical utilisation of resources, or in other words, industrial development, has come to be more and more intimately appreciated, and nations which are not in a position to meet some of their essential needs have harnessed science to make good the deficiencies by evolution of new processes, utilisation of new raw materials and development of substitutes. Classic examples of these are: fixation of nitrogen to produce ammonia and nitric acid, a process developed with the object of doing away with dependence on imported Chile salt-petre, production of sulphuric acid from gypsum in Germany during World War I, an instance of using new materials to meet defence requirements and the Fischer Tropsch's and Bergius' processes for production of synthetic petroleum products from coal.

Defence also aids science and industry by accelerating the pace of industrial development.

\* Summary of an Address to the Defence Science conference in New Delhi, delivered by Dr. S. S. Bhat agar, on 21st April 1952,

thereby providing new sinews for the progress of science and its application to useful ends. Rapid developments in the use of radar and sonar in many spheres like radio location, detection of hostile aircraft, guiding of bombers and bombing and location of submarines, have opened up innumerable possibilities for the application of these sciences in civil aviation, commercial navigation and several other similar fields. The availability of radio-active isotopes in relative abundance as a result of quick developments in the field of nuclear energy has provided new tools for scientific investigations in agriculture, industry and public health. The rapidity with which penicillin, streptomycin, aureomycin, atabrin, DDT and several other insect repellents and insecticides were developed and produced under the stress of war has been an invaluable contribution of defence in prevention and avoidance of disease.

In India also defence has been giving a fillip to science and industry. The tempo of industrial development was stepped up during the two world wars, and production of many new

items was established mainly to meet defence demands and in some cases to meet shortages created by war conditions. One of the major contributions of World War II was the rationalisation of production in cotton, woollen and jute textiles. Leather and rubber are some other industries which benefited similarly. The emphasis on industrial products coming up to certain specified standards has to a certain extent been responsible for introducing standard methods of production and raising the quality of some Indian products to bring them on a par with imported material.

Besides, an analysis of the statistical data relating to education in scientific subjects shows that World War II inculcated an increased interest in science, and the number of students taking the I.Sc. and B.Sc. examinations began to show an appreciable increase from 1940-41 onwards. The establishment of a Board of Scientific and Industrial Research in 1940 and the Council of Scientific and Industrial Research in 1942 was primarily intended to utilise science in making India an efficient supply base. This is borne out by the resolution creating the Board in which emphasis was particularly laid on the development of industries whose importance or possibilities had been prominently brought to the forefront as a result of conditions created by the war. The expansion of these activities to cover the whole sphere of industrial development was a logical consequence of this step.

The scope of these influences has, however, been limited because of the nature of the 'basic' political set-up obtaining till recently. Major defence requirements were obtained from the U.K. and other foreign countries and only the barest minimum were met from indigenous resources. These conditions have been gradually changing and greater reliance on the ability of industrial concerns within the country to meet defence requirements is evident, but the lack of an organisation in the Ministry of Defence which could look at problems from a scientific point of view retarded the healthy development of these impacts. The setting up of the Defence Science Organisation three years ago is an indication of the change in outlook and now that this Organisation has established itself firmly, it should assume a more active and prominent role in effectively influencing progressive developments in certain specified fields of scientific research and industry.

In America the expenditure of the War and Navy Departments, excluding A.E.C., on research and development totalled 500 million

dollars in 1947. Of this only 20 per cent. was spent in Governmental laboratories while 80 per cent. took the form of contracts with industrial and university laboratories. Not all this money was for applied research only; a portion, though a small one, of 35 million dollars also went to promote basic research. These figures are just illustrative of the extent to which defence organisations in the U.S.A. support research in Universities and other industrial laboratories. While it is not suggested that the Defence Science Organisation in India should at the very start begin supporting educational and research institutions on the same scale, a beginning in placing of research contracts with various research organisations is immediately called for. Besides promoting science in general, such a step will also assist in training of technical personnel in specialised fields to meet defence requirements.

In this respect the various National Laboratories of the Council of Scientific and Industrial Research offer a unique opportunity for active collaboration. For instance, the Central Food Technological Research Institute, Mysore, could take up investigation on canned rations of various types and their behaviour on storage under different conditions. It has already developed a canned vegetable curry which is highly nutritious and will, I am sure, be appreciated by the armed forces. Similar collaboration in ultrasonics and electronics particularly with the National Physical Laboratory can lead to very useful results. India has a long coast-line extending over nearly 2,500 miles, yet no detailed coastal map of India has so far been prepared. One of the major undertakings awaiting the Defence Science Organisation is a regular survey of the coastline and the surrounding seas and in the execution of this project, ultrasonics can play a major role.

Extension in practical applications of electronics is also possible in various fields and by subsidising research in this subject, defence will be laying the foundations for the establishment of an electronics industry within the country.

The same applies to other National Laboratories. The National Chemical Laboratory could, for instance, assist in evolution of simple devices for desalting of water. It could also undertake on behalf of defence basic studies of new explosives. The Fuel Research Institute could help in the study of improved methods of coking and carbonisation to obtain better yields of benzene, toluene, phenol and other similar essential chemicals. It should

also be possible to consider jointly how far establishment of petrochemical industries in meeting some of these requirements is feasible.

In the field of industry also, there are several items which defence should either take up on its own or subsidise directly with a view to establishment of industrial production of some essential raw materials. The priorities which defence requirements command carry the added advantage of ruling out ordinary economic considerations. In many cases establishment of indigenous production is essential although it is obvious that to start with, costs will be higher, appreciably higher, in many cases. An example that readily comes to mind is that of phosphorus, initiation of manufacture of which under present conditions would be uneconomic without direct support from defence.

Besides engineering industries, the ordnance factories of defence include a number of chemical industries which have now been running for a long period. In this connection, reference may be made to the manufacture of acetone from alcohol and oxidation of ammonia to produce nitric acid. The affairs of these factories are at present defence secrets, but I do believe that a stage has now been reached when it should be possible to reveal the economics of manufacture so that the experience gained may prove useful in arranging production of these materials for ordinary industrial purposes.

Subjects which will receive prominent attention during this week's conference are ballis-

tics, operational research, personnel research and environmental physiology. I am glad a whole afternoon is being devoted to the study of 'Ballistics in Universities' and I have every hope that in the contributions to the discussion, the significant need of support, both moral and material, to the development of this subject in the Universities will be fully brought out. The same remarks apply more or less to the other subjects, operational and personnel research.

As one of the largest employers in the country the defence organisation has indeed "

and avoidance of various diseases, causes of nutritional deficiency and ways and means of making these good, etc. These studies are at present restricted to particular areas and conditions obtaining in defence establishments and camps. Provision of facilities to State and social workers in extending these investigations and preventive measures to other areas in collaboration with defence personnel offer, a unique opportunity for collaboration with defence in making effective contributions in promotion of general national welfare. This association cannot fail to have far-reaching educative effects on the masses of India and will doubtless serve to raise their general standard of living substantially.

#### TRACER TECHNIQUE IN AGRICULTURE

WITH the aid of radio-isotopes it has become possible to trace nutrients through the soil, into roots, and thence through plants, to measure the extent and speed of their movement; to determine at what stage in its growing cycle a plant needs fertilizer most; to know where and how fertilizer should be placed to give the plants the maximum benefit; to establish what kinds of fertilizers work best in the country's varied soils; and to answer other practical questions about the techniques of fertilizer use. Such probing is rather necessary as experiments made during the past few years have shown that crops differ widely in their abilities to use natural phosphorus from the soil or from commercial fertilizers. Also, tests made on many crop plants seem to emphasise that the beneficial effect of fertilizers depends greatly on the form of phosphate used, when it is applied, and where in relation to the seeds. Other work with radio-isotopes relates to the biological sources of plant nutrients with a

view to study the mechanism whereby plants receive nourishment from organic matter in the soil and the way in which bacteria on the roots of bean plants build up the nitrate content of the soil to nourish future generations of growing plants. Still further research is being done on the nutritional diseases of plants and sickness of trees.

Crop pests do damage to the extent of 6 billion dollars a year in the U.S.A. alone. By building radio-active isotopes into the chemical structures of pest-killing preparations, researchers gain clearer knowledge of their basic action, their advantages and limitations. Radio isotopes are peculiarly useful in this field because insecticides and weed killers are ordinarily used at such low concentration that detecting them by other means is difficult or impossible. As tags on food given to air-borne fungi and insects, isotopes are used to 'label' these species and map their patterns of dispersion.

## ROLE OF DIETARY FACTORS IN EXPERIMENTAL LIVER INJURY

P. K. VIJAYARAGHAVAN AND V. N. PATWARDHAN

(Nutrition Research Laboratories, I. C. M. R., Coonoor, S. India)

LIVER cirrhosis is of frequent occurrence among poorer classes of Indians, but its ætiology remains rather obscure. Accumulated data from clinical findings indicate that dietary deficiency may be an important ætiological factor and that alcohol which is believed to be a contributing agent in the production of this disease among European populations cannot be implicated as a cause among Indians.<sup>1-3</sup> Definite evidence regarding the role of various dietary factors in the production and prevention of different types of liver injury has been forthcoming from experiments with animals. The relation between diet and hepatic damage has only recently received the attention it deserves. It was Weichselbaum in 1935<sup>4</sup> who first demonstrated that individual dietary factors alone can cause injury of the liver in rats. He noticed that deficiency of sulphur containing amino-acids caused death with 'hæmorrhage' of the liver. Since then greater attention is being paid to trace the defects in the diet which are ultimately responsible for portal cirrhosis in human beings.

The volume of experimental work on the production of different types of liver lesions accumulated during the last ten years is considerable and it becomes somewhat difficult to classify systematically all the types of liver damage produced by dietary means by various workers. Fatty infiltration followed by diffuse hepatic fibrosis produced in animals by diets rich in fat, low in lipotropic factors forms one kind. Hershey and Soskin's<sup>5</sup> preliminary experiments on the use of lecithin to cure fatty livers produced in depancreatized dogs stimulated Best and co-workers<sup>6-10</sup> in their identification of choline, a constituent of phospholipids, as an important lipotropic factor. The lipotropic activity of casein and other proteins is attributed to the presence of methionine contained in them.<sup>11-14</sup> By the use of methionine labelled with radio-active carbon as well as deuterium and N<sup>15</sup>, du Vigneaud and associates<sup>15,16</sup> established that the lipotropic activity of methionine was due to its 'labile' methyl group which is utilised for the synthesis of choline. Accumulation of abnormal amounts of fat in the liver resulting from ingestion of high fat in the diet or from a deficiency of lipotropic factors in the diet or from both causes seems to lead towards structural changes of

liver cells such as fatty infiltration leading on to cirrhosis. Chaikoff, *et al.*<sup>17</sup> always noted high hepatic fat preceding liver damage that occurred in completely depancreatized dogs. Cirrhosis of the liver has invariably been produced in rats by feeding diets containing over 50 per cent. of fat.<sup>18-25</sup> The lesions were, however, prevented by increasing the contents of choline or methionine in the diet and a reduction in the fat content accelerated the beneficial effects of the lipotropic factors. It is thus seen that the liver lesions of animals of all these workers were always preceded by various degrees of fatty infiltration which was followed by fibrosis.

The second type of hepatic lesions produced in animals is characterised by necrosis and post-necrotic fibrosis resulting from a diet low in protein, fat and lipotropic factors. The condition is described as massive or acute necrosis with or without hæmorrhage. This type of liver injury has been successfully produced in rats by Himsworth and Glynn<sup>26-28</sup> by a protein-deficient diet. The necrosis produced, according to the authors, resembled acute yellow atrophy in man and progressed "to a condition of scarring similar to nodular hyperplasia". Cystine was found to have protective action against this type of massive necrosis.<sup>29</sup> The ingestion of methionine in a dose of 20 mg. per rat per day was completely protective. The protective action of methionine may probably be due to its breakdown to homocystine after demethylation, the liberated homocystine being the source of cystine. The above authors claimed to have produced two distinct types of liver lesions, viz., diffuse hepatic fibrosis and massive necrosis by suitable choice of deficient diets.<sup>28</sup> The former type of lesions was produced by a high fat diet with low choline and methionine while the latter was produced by a low fat low protein diet. However, the type of lesions produced by other authors with similar diets have always been mixed. Gillman and co-workers<sup>30-32</sup> found that the diet of South African natives which consisted of mealie pap (maize meal porridge) supplemented frequently by fermented cow's milk was capable of producing severe liver damage in rats. The injury of the liver usually expressed itself as diffuse fatty liver; cirrhosis, lobar absorption or diffuse lobar enlargement. Wahi<sup>33</sup> fed rats with

a synthetic high carbohydrate low protein diet, which was claimed by the author to resemble the deficient diet of vegetarian Hindus among whom many cases of cirrhosis are believed to occur, and found that their livers showed varieties of lesions like focal or diffuse necrosis, fatty infiltration and incipient cirrhosis. He also noticed that the type of liver damage was determined by the age of the animal. Similarly, Abell, Beveridge and Fisher<sup>14</sup> induced hepatic necrosis in rats by feeding them a diet low in protein. During the pre-necrotic period the livers showed significant loss of cytoplasm; the biochemical changes observed were, fall in liver weight and progressive increase in liver lipids.

The sulphur containing amino acids methionine and cystine, are now known to be particularly concerned in the maintenance of the integrity of liver cells. The importance of methionine as a lipotropic agent and as a curative agent against massive necrosis has already been indicated. Dietary cystine is known to exert three effects: (a) Complete lack of this amino-acid in the diet leads to massive necrosis.<sup>27</sup> (b) If the dietary methionine is suboptimal, cystine may exert an alipotropic action.<sup>35,36</sup> Two views regarding the alipotropic action of cystine are put forward. The first postulates antagonistic action of cystine against the lipotropic action of methionine and according to it the extent of injury depends on the ratio between them. The second ascribes the unfavourable action of excess of cystine to its power of promoting growth when supply of dietary methionine is suboptimal. (c) Large doses of cystine produce hæmorrhagic necrosis of the liver.<sup>37-38</sup> Methionine appears to be the key substance involved in liver disease and promises to be important because of having both the 'labile' methyl group as well as the sulphydryl group which are known to play important parts in protecting liver cells.<sup>39,40,41</sup> Methionine has been known to lessen the damage to liver or improve the chances of recovery from toxic chemical agents such as chloroform,<sup>42</sup> carbon tetrachloride<sup>43</sup> and pyridine.<sup>44</sup>

The relationship between the deficiency of vitamins and hepatic injury was noticed by Patek<sup>45</sup> and Patek and Post<sup>46</sup> who obtained favourable results in the treatment of hepatic cirrhosis in humans by 'high vitamin therapy' particularly with B complex vitamins. The influence of individual vitamins of the B group on liver injury was studied by various workers. Thiamine, riboflavin, pyridoxine and nicotinic

acid were not found to have any beneficial effects on Laennec's type of cirrhosis produced in rabbits by Rich and Hamilton.<sup>47</sup> Thiamine<sup>48</sup> and biotin<sup>49</sup> were found to favour the deposition of fat in the liver; choline was curative against thiamine induced fatty liver while biotin fatty liver was prevented by inositol. Chronic vitamin A deficiency in rats was not found to produce any type of lesions described above.<sup>50</sup> The sparing action exerted by vitamin E on sulphur containing amino-acids in the prevention of massive necrosis has been definitely claimed by Himsworth and Linden<sup>51</sup> and Gyorgy and Goldblatt.<sup>52</sup> These results were in confirmation of the earlier findings of Schwartz<sup>53</sup> and Gyorgy.<sup>54</sup> The results of Schaefer, Salmon and Strength<sup>55</sup> on the interrelationship of vitamin B<sub>12</sub> to choline indicated the probable lipotropic activity of this most recently isolated vitamin. Vitamin B<sub>12</sub> was also found to exert a methionine sparing action in pigs, chicks and rats fed a methionine-deficient diet.<sup>56-59</sup> Popper, *et al.*<sup>60</sup> and Koch-Weser, *et al.*<sup>61</sup> found that administration of vitamin B<sub>12</sub> to rats preceding acute carbon tetrachloride intoxication inhibited the development of histological changes of the liver while Gyorgy and Rose<sup>62</sup> reported that vitamin B<sub>12</sub> exhibited marked lipotropic activity in rats maintained on a low protein, low fat ration, but had no effect on the development of massive necrosis. It is of interest to find that preliminary studies made on the effect of vitamin B<sub>12</sub> in infantile cirrhosis have shown beneficial effects attributable to the vitamin.<sup>63,64</sup>

Among the antibiotics aureomycin was found by Gyorgy<sup>65</sup> to have protective effect on massive necrosis.

Literature surveyed so far establishes beyond doubt the role of various dietary factors in the production and prevention of different types of hepatic injury. The importance of choline and methionine and to a lesser extent that of vitamin E and vitamin B<sub>12</sub> can very well be recognised. Animal experiments designed to produce liver damage by dietary means have mostly been conducted with synthetic diets which were highly purified and consequently different from the natural diets of communities in which cirrhosis of the liver is fairly common. In actual practice it happens that the various factors whose deficiency leads to one or the other type of liver injury reported tend to occur together thus complicating the picture. In considering liver injury in human beings there is no justification for the assumption that the effect of a natural diet containing various

factors in varying amounts will be same as that of a pure synthetic diet whose composition is definite and well known. This consideration makes it important to study the influence on the liver of natural deficient diets consumed regularly by populations among whom there is a high incidence of liver disease. Vijayaraghavan and Patwardhan<sup>66</sup> conducted experiments to examine the possibility of producing liver injury in rats by feeding a typically deficient poor rice diet. With such a diet early degenerative changes and marked rarefaction of the cytoplasm of parenchymal cells were seen after 15 and 21 months of experimental duration.

The results obtained from animal experiments do indicate, therefore, to some extent the probable aetiology of liver diseases among human beings who are consuming deficient diets. Though it is difficult to assume that the results from these experiments are fully applicable to humans, yet there is some justification for believing that the liver damage in man may also be determined by some of the factors responsible for liver injury in experimental animals when it is realised that the deficiencies in the human diets are almost the same.

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## SYMPOSIUM ON INTERNAL COMBUSTION ENGINES

A Symposium on Internal Combustion Engines was held in the premises of the Indian Institute of Science, Bangalore, under the joint auspices of the C.S.I.R. and the Indian Institute of Science on the 5th and 6th of April 1952. The occasion was well attended and representatives of various Departments of the Government of India, the National Laboratories, the I.C.E. Industry, Oil Companies and Universities participated in the activities.

The inaugural session was held under the Chairmanship of Dr. J. C. Ghosh, who presented a brief review of the position of the I. C. Industry in the country and the various activities of the Council of Scientific and Industrial Research, at the Indian Institute of Science, Bengal Engineering College and other Industrial firms that were working towards the progress of the Industry. Dr. H. A. Havemann explained the details of the Gas Turbine test house, diesel and aero engine developments and other work carried out in the Internal Combustion Engineering Laboratory. Dr. S. R. Sen Gupta gave a brief account of the research work on Gas Turbine conducted at the Bengal Engineering College, Sibpur. Prof. M. S. Thacker gave an outline of what assistance the various Departments in the Institute were giving and would continue to give, towards the furtherance of research for and progress of the I. C. Industry.

The delegates were then taken round the Internal Combustion Engineering Laboratory and shown various items of research work under progress. U-type two-stroke Diesel engines, Low Pressure Fuel Injection in Diesel Engines, Aero engine with Fuel Injection for Aircraft Propulsion, Cyclone Gas Producers, Injection Device for Pulverised Fuel, Test-rig for Derwent V Aero-gas Turbine, Test-rig for Gas Turbine Combustion Chambers, High Speed Diesel Engines running on heavy fuels, Hot Air Engine, were some among the special exhibits.

Items of research in progress related to: Effects of Turbulence on Combustion, Heat Transfer in Oscillating Gases, Cyclone Air Filtration. The morning session came to a

close after a demonstration run of the turbojet engine in the Internal Combustion Engineering Laboratory.

The afternoon session held under the Chairmanship of Dr. S. R. Sen Gupta was devoted entirely to a discussion of the "Design Trends in I.C. Engines". 12 Papers were presented, dealing with petrol engines for road transport, automotive engines running on producer gas, a new hot air engine, low pressure injection for Diesel engines, scavenging of two-stroke Diesel engines, experimental aero-engine, testing of gas turbines, progress of Diesel engine manufacture in the country, etc.

The morning session on the 6th was presided over by Dr. J. W. Whitaker to discuss "Fuel and Combustion Problems". 12 Papers were presented dealing with the production of power alcohol, use of heavier fuels in Diesel engines, cyclone gas producer, indigenous fuels for I.C. Engines, some aspects of combustion in I.C. Engines, injection of pulverised fuel into pressurised chambers, standardised tests for lubricants, etc.

During the afternoon session, presided over by Prof. M. S. Thacker, a number of papers were presented dealing with the Production, Materials and Component Manufacture. Papers were read on spheroidal graphite, cast iron and meehanite in I.C. Industry, high duty materials for engine components, air-cleaners, gears, mechanical wear, etc.

The last part of the afternoon session was devoted to the discussion of technical aid to industry by research organisations. The discussion was very lively, and representatives of manufacturers, heads of research organisations and university professors took part. As a result of these discussions it was possible to define what industry expects from technical institutions and in turn, what help the technical institutions require from industry to carry out the suggestions made by representatives from industry.

Fuller details of the proceedings will be published in book form by the Council of Scientific and Industrial Research in due course.



## TETRAZOLIUM BROMIDE AS A VALUABLE TOOL IN MICROBIOLOGICAL WORK

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IN the course of our studies on the reducing activities of bacteria of dairy importance, 2:3:5 triphenyl tetrazolium bromide\* was found to be a very useful oxidation/reduction indicator with a variety of possible applications in microbiological research. The use of tetrazolium salts has been reported previously in connection with the testing of seed viability,<sup>1,2</sup> for the colorimetric estimation of reducing sugars and other reducing substances,<sup>3,4</sup> for vital staining<sup>5</sup> and for the *in vitro* studies of certain dehydrogenase activities.<sup>6</sup> However, its use in microbiological work has not received much attention.

Triphenyl tetrazolium bromide is soluble in water and forms a colourless solution, but in its reduced state (formazon) the indicator assumes an intense cherry red colour and is also insoluble in water. Formazon is, however, soluble in benzene, pyridine, glacial acetic acid, oleic acid, chloroform, butyl alcohol, propyl alcohol and other organic solvents. Its  $E_0$  has been reported to be 0.08 volts.<sup>7</sup> The reducing substances present in raw and heated milks and in autoclaved bacteriological media have no effect on this indicator (unlike methylene blue or resazurin) except under strongly alkaline conditions and at high temperatures. Any appreciable reduction of the indicator in culture media may, therefore, be ascribed to the reducing systems of bacteria during their growth and metabolic activities. The red dye can be extracted with a suitable solvent and measured quantitatively in a photo-electric colorimeter.

While studying the reducing activities of various organisms in milk and other media using tetrazolium bromide as an O/R indicator it was observed that the visible production of the red compound "formazon" started just after methylene blue and resazurin were completely reduced to their leucobases under comparable conditions ( $E_h$  of medium  $-0.05$  to  $+0.20$  V.) and the colour became intense at a stage corresponding to the complete decolourisation of Janus Green B ( $E_h$  of medium  $-0.20$  to  $-0.15$  V.). Preliminary work suggests that the reduction of the dye takes place mostly within the cell and partly on the cell surface and in the former case the red dye may diffuse into the medium along with organic solvents either

in the normal course or as a result of the autolysis of some of the cells. The cell-free filtrate was not found to be capable of reducing the indicator. Like other dyes, tetrazolium (in concentrations of 0.1 per cent. and higher) was also found to exert some influence on the growth and acid production of the organisms in the early logarithmic stage of growth. The extent of inhibition or stimulation depends on the species and numbers of organisms as well as on the nature of the medium. The possibilities of using this indicator for the following aspects of microbiological research have been studied.

(i) *Taxonomical studies.*—Different species of bacteria showed significant differences in the rates of reduction of tetrazolium. The dye was found to be reduced most markedly by the lactic acid bacteria as a group but there was considerable variation from species to species within the same genus. For example, *Streptococcus liquefaciens* and *S. faecalis* were the most powerful reducers while the heterofermentative streptococci showed the least reducing effect. Among the lactobacilli, *Lactobacillus lactis* and *L. bulgaricus* reduced the dye more strongly than other species. In the case of some species the red compound appeared to undergo further changes in colour on prolonged incubation of the culture. This differential behaviour of the organisms would appear to be helpful in their taxonomic classification and in the study of their metabolic activities. Sugar fermentation reactions and other biochemical tests commonly employed in classifying bacteria can be followed rapidly by observing the reduction of tetrazolium by the organisms in different media.

(ii) *Nutritional requirements of bacteria.*—The reduction of the indicator by growing cultures of bacteria was considerably influenced by the nutritional adequacy of the medium apart from the effect of cell population. By growing the organisms, in the presence or absence of various nutritional factors and then quantitatively measuring the reduced dye it has been possible to determine the specific nutritional requirements of different organisms within a short period of 6 to 8 hours. In the case of certain species, significant differences between their dye reducing capacities and their growth and acid production were also observed.

\* Trade name: Grodrex—May and Baker product.



(iii) *Microbiological assay of vitamins, amino acids, etc.*—An interesting application of the relation between the nutritional requirements of the organisms and their dye reducing abilities has been found in the use of this indicator for microbiological assay of riboflavin. An external source of riboflavin was found to be essential for the reduction of tetrazolium by *Lactobacillus plantarum*-89, *Streptococcus faecalis*-190 and a few other organisms. The response of the test organism to graded doses of pure riboflavin was assessed in terms of the amount of formazon (intensity of red colour of the butanol extract) produced in the medium in about 6 to 8 hours and was found to be linear, like the response measured on the basis of acid production after 48 or 72 hours. The method has given encouraging results for the microbiological assay of riboflavin in milk. It is suggested that this principle of measuring the reducing activities of organisms as a basis for the assay of other vitamins, amino acids and other factors offers great possibilities.

(iv) *Quality control of milk.*—Dye reduction tests using methylene blue and resazurin have been widely employed in the quality control of milk. Tetrazolium, which does not impart any colour to milk initially, gradually colours it red as a result of its reduction to formazon by bacterial activity. It was found that poor quality milks with high bacterial numbers (plate counts over one to 10 million cells per ml.) became intensely red in 3 to 4 hours. The extent of reduction could be measured and standardised against suitable gradations of colour prepared by adding safranin and methyl orange to sterile milk. Although this indicator is not likely to be of much use for the rapid platform testing of milk, it appears to be par-

ticularly useful in quality improvement programmes for dramatically demonstrating to the producers the poor quality of milk and the need to improve their methods.

(v) *Other applications.*—The indicator is basic in character and can be used as a vital stain. In growing cultures of organisms like *Lactobacillus bulgaricus* in a medium containing the indicator, the metachromatic granules are stained intensely red. This also indicates the possibility of the use of tetrazolium for the quantitative determination of nuclear materials in the cell.

It was also observed that the addition of a small amount of the indicator (in non-toxic concentrations) to the agar medium resulted in the development of red pigmented colonies against a colourless background, thus making the enumeration of colonies easier. This method has been found particularly useful in counting cells by the 'Frost Little Plate' method since the small colonies developed in 4 to 6 hours are intensely red coloured and can be easily counted under the microscope.

Detailed results on some of the aspects referred to in the note will be published elsewhere.

We are grateful to Dr. K. C. Sen, Director of Dairy Research, for his keen interest in the work.

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## NEW THEORY OF SUNSPOTS

DR. S. CHANDRASEKHAR, Professor of Theoretical Astrophysics at the University of Chicago's Yerkes Observatory, was awarded the Bruce Medal, top American honour in Astronomy, presented annually by the Astronomical Society of the Pacific. Accepting the Medal, Prof. Chandrasekhar presented for the first time his new theory of the origin of sunspots.

The gist of the theory is that strong magnetic fields inhibit the movement of fluids by convection. Normally, convection currents are present in the body of the sun, whereby hot gas from far down moves up to the surface, gets cooled and then turns down again. This

constant upwelling of hotter gas from below keeps the sun's surface bright. According to Prof. Chandrasekhar, strong magnetic fields on the sun's surface create a force which prevents the upwelling of the gas beneath the field. Since hot gas cannot come up to replace the cooled gas at the surface, the gas swirls around and cools off further, thus reducing its brightness and leading to the presence of dark sunspots.

The new theory is likely to offer a means of improving weather forecasting and lead to a better understanding of movements in the earth's atmosphere and of the gases within the sun and other stars.

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## PLASTIC DEFORMATION IN BEAMS\*

THE plastic behaviour of a material loaded beyond yield may be compared to that of a highly viscous fluid. For equal deformations in the plastic and elastic states, the stress for plastic deformation is much less than that for the elastic state, with the result that the sustained stress in the former state tends to fall. This gives rise to the upper and the lower yield points. In the stress-strain diagram these two points are clearly marked for structural steels, whereas in ductile materials the difference between them is not so marked. The corresponding stresses, i.e., the upper and the lower yield stresses, the difference between which may be as high as 25% of the higher stress, are very important and introduce many complications in the theory of plasticity.

If it is considered that the change from the elastic to the plastic region in a material which

is in an elasto-plastic state of stress occurs over a layer which is very thin, then the gradient of the stress and hence the instability in this layer would be large. If this layer has a finite thickness, then the stress gradient and consequently the instability would be small. In any case this layer appears to spread fast initially and then slowly till the whole material goes into a plastic state. Hence the criterion for determining the working stresses in a material is the lower yield stress rather than the upper yield stress. This elasto-plastic region has its analogues in hydrodynamics, the methods of which may be applied here also.

If this layer is sufficiently thin to be considered infinitesimal, it may be treated as a shock. If it has an appreciable thickness, it may be considered analogous to a boundary layer which is a region of distributed vorticity and can be laminar or turbulent, and which

may "separate" or generate secondary flow. These concepts may be used in an investigation of the elasto-plastic flow.

If the elasto-plastic interface is treated as a shock, then the normal stress components  $f_{t1}$  and  $f_{t2}$  parallel to the interface need not be equal, though the other normal stress components and the shear stresses on either side of the interface are equal and continuous. The jump in  $f_t$  is given by Prager<sup>1</sup> as:

$f_{t2} - f_{t1} = \pm (4k^2 - \tau^2)$ ,  
where  $k$  = maximum shear stress at yield point  
and  $\tau$  = shear stress on either side of discontinuity surface.

From an engineering point of view, the moments of rectangular beams under pure bending have been calculated for the following cases:

(a) Within the yield point, (b) above the yield point beyond some point P for structural steels where the stress falls to the lower yield and (c) above the yield point as before for ductile materials where the stress is sustained at the upper yield (see Figs. 1 a, b and c).

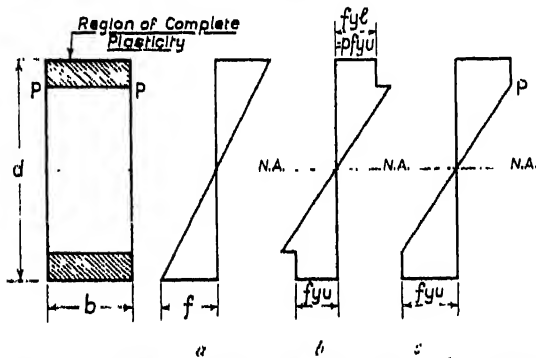


FIG. 1. Idealized stress diagrams for: (a) Elastic bending. (b) Plastic bending of structural steels. (c) Plastic bending of ductile materials.

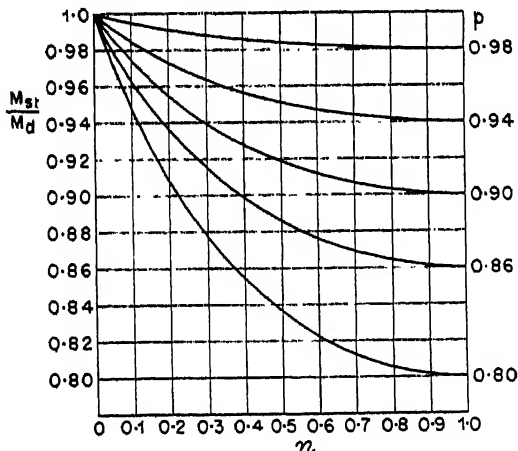


FIG. 2. Ratio of Plastic moment in structural steels to elastic moment.

$$(a) M_e = \frac{f_{yu}}{6} b d^2$$

$$(b) M_{st} = \frac{f_{yu}}{12} b d^2 \{ p [ 3 ( 3 - 2/p ) ( 1 - n )^2 ]$$

$$(c) M_d = \frac{f_{yu}}{12} b d^2 [ 3 - ( 1 - n )^2 ]$$

where  $n$  is the fraction of semi-depth gone into the plastic state.

The curve showing the variation of the ratios of the two last moments with increasing depth of the plastic region is given in Fig. 2, for various values of  $p$  as parameter. It is seen that the percentage reduction in plastic moment reaches asymptotically the percentage drop in yield stress, as plastification spreads to the neutral axis. It is, therefore, evident that the effect of lower yield cannot be ignored.

Ind. Inst. of Science, Y. V. G. ACHARYA.  
Bangalore, G. JANAKI RAM.  
March 21, 1952.

\* Original paper presented at the Technical Session of the Aeronautical Society of India, in March 1952.

1. Prager, W. *Current Anniversary volume*, 1948.

## DILATATION OF ELECTROLYTIC COPPER POWDER COMPACTS

THE nature of dilatation curves obtained with "fine" copper powders has been described by Tzrbiatowsky,<sup>1</sup> who does not mention the details of fabricating the compacts. The author has corroborated Tzrbiatowsky's work while studying the nature of sintering of electrolytic copper powder compacts.<sup>2-3</sup> It is intended here to put briefly on record the dilatation curves of compacts made from electrolytic copper of different particle sizes, viz., ( $-40 + 100$ ), ( $-100 + 200$ ), ( $-200 + 300$ ) and ( $-325$ ) mesh, briquetted at 25 tons per square inch. For ease of reference, the particle sizes are respectively mentioned below as A, B, C & F.

The powder compacts made in the manner described by Gupta<sup>4</sup> were heated in a stream of pure hydrogen in a dilatometer shown in Fig. 1. The instrument was calibrated using

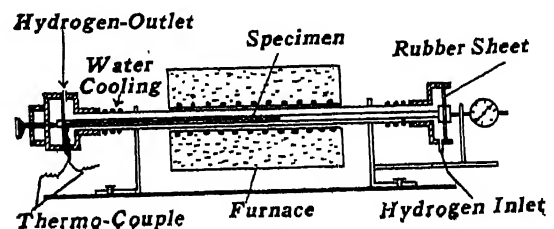


FIG. 1

austenitic steel (18/8 Ni-Cr) of known thermal expansion. The dilatometric curves obtained with 3.0 inches long specimens are shown in Fig. 2 where the dial reading (inches) of the

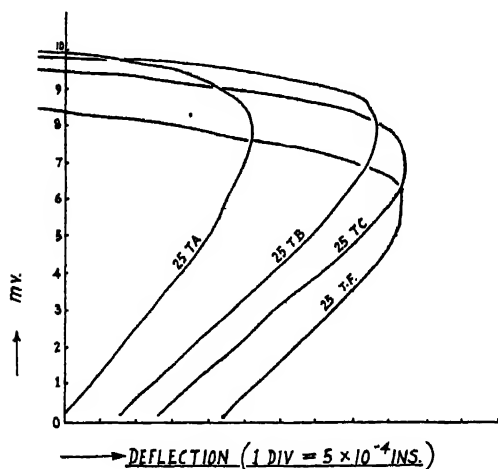


FIG. 2

Mercer gauge is plotted against the voltage (m.v.) of the thermo-couple (Pt-10% Pt/Rh). The latter was inserted within an 1/8th inch diameter 1/4 inch deep hole at one end of each specimen. The changes in length have been noted against every 0.1 m.v. rise. The observed points were therefore so close that they have not been shown in the curves. In the figure, the origin for each curve has been progressively shifted to the right to avoid overlapping.

The general trend of the curves is the same, i.e., increase in length with temperature followed by a rapid decrease. The temperature at which rapid contraction occurs depends upon the particle size; thus the smaller the particle size the lower is the temperature at which expansion ceases and contraction commences. Further the smaller the particle size the greater is the extent of contraction. The nature of the curves remained unchanged in *vacuo*, nitrogen and carbon dioxide atmospheres.

If a specimen once heated in hydrogen is allowed to cool in the dilatometer in the same atmosphere and reheated in the same manner, the nature of curve is altered. The change is very pronounced with compacts made from the smallest particle size of the powder. On repeatedly heating a specimen made from -40 + 100 mesh particle size the gradual change observed in the curves becomes less and less. Calculating  $\alpha$  in a manner similar to Tzrabiatsowsky, from the straight

portion of the curve obtained after the 5th heating of the same specimen (particle size A), the value obtained was  $18.68 \times 10^{-6}$  cm./°C.

The above work was carried out at Hadfield Research Laboratory, The University, Sheffield. The author is indebted to D.S.I.R., London, for the grant in aid.

Development Research Lab., A. GUPTA.  
The Assam Oil Company, Ltd.,  
Digboi, Assam,  
March 4, 1952.

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### MANGANIFEROUS MICAS OF INDIA

I HAVE read with interest the letter dated October 20th, 1951, on page 43 of Volume 21 of your Journal.<sup>1</sup>

As a result I have consulted what I wrote on the Indian manganiferous micas in 1909.<sup>2</sup> I find that I divided the Indian manganiferous micas into two groups according to colour, placing the brown micas under manganophyllite, (?) and the crimson and pink micas under alurgite (?). These question marks were appended because the Indian examples had not been analysed chemically. The "rich brown, bronze, or deep orange" micas that I grouped under *manganophyllite*, with a query mark (*loc. cit.*, p. 196), were some of them uniaxial and some of them biaxial, as is the case with biotite, with which Dana groups *manganophyllite*.

The term *alurgite* was applied by me to micas of crimson or pink colour, and I was encouraged to do this not only because of the colour but because of the high optic axial angle agreeing with that of *alurgite* from the original locality, St. Marcel, Piedmont, Italy, as determined by Penfield.

The reasons why the mica noticed by Mr. Bilgrami as *alurgite* should not, I suggest, be so described are twofold: the colour as described is not correct and the mineral as described is either uniaxial or nearly so. It is fair to Mr. Bilgrami to note here that Breithaupt originally described the mineral as uniaxial, but that Penfield later determined the optic axial angle as  $56^{\circ}5'$  to  $57^{\circ}$ . (See Dana, p. 635, and Appendix I).

The most interesting association of these Indian manganiferous micas noticed by me occurred at the Sitapathur manganese mine in the same district (Bhandara) as Sitasangi. The association was in a rock composed largely of a rose-red mica (alurgite?) with a bronze mica (manganophyllite) with also scattered grains of a black manganese-ore.

The optic axial angles of alurgite and manganophyllite as given by Dana were: Alurgite,  $56^{\circ}$ - $57^{\circ}$ ; Manganophyllite—not given, but that of biotite under which this mica is grouped by Dana is usually sensibly uniaxial, though the optic axial angle of biotite is occasionally as high as  $50^{\circ}$ .

Both of Mr. Bilgrami's micas from Sitasangi, judging from his description, would have been grouped provisionally by me under my manganophyllite(?), though, as I then noted, there must be at least two species amongst the Indian brown, bronze and deep orange micas. There may also be more than one mica sheltering under my alurgite(?).

It was for the benefit of, and to encourage future research that I recorded the incomplete data given in my memoir on "The Manganese-ore Deposits of India". I do not think that much progress will be made in the determination of our Indian manganiferous micas until some one finds the time to make a complete optical and chemical study. Optical work alone is not enough. The best material upon which to commence work would be the rock from Sitapathur with its association of crimson-pink and orange-brown micas (*loc. cit.*, p. 740). At present all we can say is that the pink manganiferous micas are probably more closely allied to the muscovite group and have large optic axial angles; and that the bronze or brown micas belong to the biotite group and have optic axial angles varying from nil to an occasional high figure.

24, Durdham Park,  
Bristol 6,  
March 29, 1952.

L. L. FERMOR.

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2. Fermor, L. L., *Mem. Geol. Surv. India*, 1909, 37, 195-99.

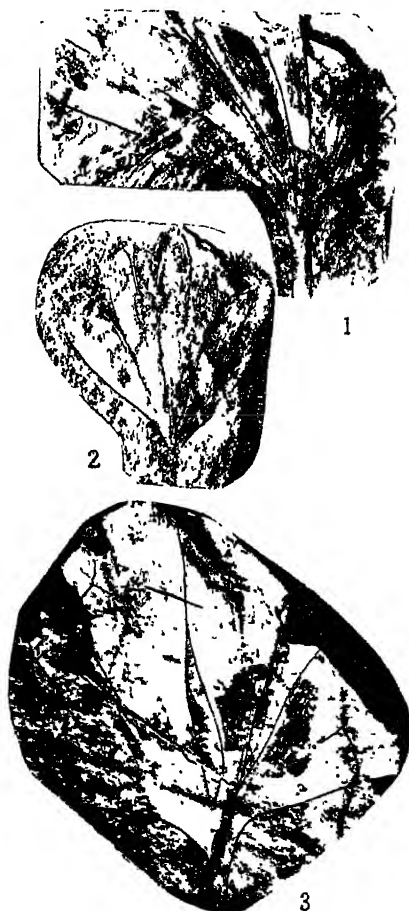
#### OCCURRENCE OF GINKGOALES IN THE RAJMAHAL SERIES OF BEHAR

THE only Mesozoic Ginkgoales known so far from India are those described by Feistmantel from the Upper Gondwanas of the Jabalpur group and the Sripermatpur area of Madras by Seward and Sahni.<sup>1</sup> There are two species based on leaf impressions: *Ginkgo (ites) lobata*

Fstm. from Sher river in the Satpura basin and *G. crassipes* Fstm. from Sripermatpur bed. A few detached linear leaves from Sher river have been doubtfully referred by Seward and Sahni (*loc. cit.*) to *Phœnicopsis*.

The specimens illustrated here belong to the Rajmahal series and are different from the Jabalpur and the Madras species. They were collected by the author from Sakrigali about 1 mile north of Sakrigali railway station in the Rajmahal Hills, Behar. The specimens occur in a bed of much weathered and friable shale, associated with genera like *Cladophlebis*, *Dictyozamites*, *Ptilophyllum*, *Pterophyllum*, *Tæniopteris* and *Elatocladus*.

Description.—Fig. 1 shows a fan-shaped leaf



FIGS. 1-3

deeply incised into five cuneate and somewhat linear segments. The upper part of the leaf is not preserved. The leaf-base tapers insensibly into a fairly stout petiole. The veins in the middle part of segments are above

0.5 mm. apart and are in places clearly seen to be dichotomous. Fig. 2 shows another leaf divided into four main segments, each of which is again partially divided into two lobes. The venation is not well preserved, but it seems to be similar to that of the first specimen. The leaf base appears to taper into a petiole, but the petiole itself is not preserved.

The specimen in Fig. 3 is bigger than the other two and possesses a petiole. The veins here are about 1 mm. apart and are seen to fork frequently.

**Comparisons.**—All the Rajmahal specimens differ from Feistmantel's *Ginkgo lobata* and *G. crassipes* in the division of the lamina into distinct segments. In the figure of *G. lobata* given by Feistmantel (*loc. cit.*, pl. 1, fig. 1) the leaf may be segmented, but the specimen is too fragmentary for this feature to be made out with certainty. The present specimens are similar to Feistmantel's species in the dichotomous nature of the veins and in possessing a petiole.

Among other Gondwana forms, our specimens are comparable to *Ginkgo digitata* described by Walkom<sup>4</sup> from the Ipswich series of Queensland. In the Rajmahal specimens, however, there is no prominent median cleft dividing the leaf into two main lobes. The veins are dichotomous in both and are placed at about the same distance apart. The specimens of *G. digitata* from other parts of the world show considerable variation in the division of the lamina, showing that the number of segments and the degree of their incision is not constant in this species.

The Rajmahal specimens may also be compared in their linear segments (Figs. 1 & 2) to *Ginkgoites sibirica*. A leaf of this species figured by Walkom<sup>5</sup> from Queensland does not show any petiole; it is similar to our Fig. 2 in the deep incision of the lamina, but the subdivision of the third order in the segments is not seen in the Rajmahal specimens.

The Rajmahal leaves are being referred to *Ginkgoites* rather than to *Baiera* because the subdivision of the lamina is an uncertain character. It is met with in the young leaves of modern *Ginkgo* and in several species of *Ginkgoites*. Moreover, in the typical specimens of *Baiera* the segments are generally greater in number and more linear than in our specimens. The presence of petiole (Harris<sup>6</sup>) also is a character in favour of placing our specimens in *Ginkgoites*. The three fossil leaves from Sakri-galighat probably represent more than one species. But owing to the fragmentary nature

of the material no specific names are being given for the present. The specimens are of interest as there is no published record of the occurrence of Ginkgoales in the Rajmahal series.

Birbal Sahni Inst. SATISH CHANDRA DAS SAH.  
of Palaeobotany,  
53, University Road,  
Lucknow,  
March 5, 1952.

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4. Walkom, A. B., *Queensland Geo. Surv. Pub.* 1917, No. 259, Pt. I, Pl. 1, figs. 3-4, 8-9.
5. —, *Rep. Mem. Queensland Museum*, 1924, 8, Pt. 1, Pl. 21, fig. 4, 88 89.
6. Harris, T. M., *Medd. Om. Grœn.*, Bd. 112, Nr. 1, 1935, Pt. 4, 47-50.

#### USE OF LIGHT OF DIFFERENT INTENSITY AND COLOUR IN LURING FISH

JAPANESE fishermen have developed methods of luring fish by using artificial light.<sup>1,2,3</sup> Typical of these are the "stick-held dip-net", "set-net" and "purse-seine-net" fishing. In these operations they use electric bulbs of 150-500 watts power. Though the principle underlying the process is known in India, no attempt has hitherto been made to study the various aspects of the problem on a scientific basis.

Many types of "Chinese balanced-dip-nets" are being used for fishing in the backwaters of Travancore-Cochin State. During dark nights, these nets are operated with lantern or petromax light for luring fish. These "China nets" have been made use of in the present investigations to study the effect of light of different intensity and colour in attracting different species of fish and prawns.

Regular collection of fish at definite intervals was made from these nets during the various seasons, with the following lighting arrangements: (a) Lantern: 14 c.p.; (b) Sealed beam reflector: 6 v., 15 w., white, green, blue and red colours; (c) Petromax: 200 c.p., white, green, blue and red colours; (d) Electric bulbs: 230 v., 60 w., 100 w., 200 w., and 300 w. in white, green, blue and red colours.

Using the same net the average catch for each colour and intensity was compared with the value for a 14 candle power lantern as standard. Care has been taken to maintain uniformity in the timing of dips and in assessing the

catch each time. This comparative study was conducted in all the three lakes, viz., Ashtamudi, Kayamkulam and Vembanad under varying ecological conditions.

Our observations are as follows :

- (1) There is a definite increase, ranging from 200-600% in the total fish catch with the increase in the intensity of light used, up to a maximum of 200 watts, after which the catch decreases.
- (2) Green, blue and red-coloured lights were more effective than white light in attracting fish and prawns, the green colour being most effective.
- (3) With coloured lights, the bulk of the prawn catch generally consists of large specimens of *Penæus indicus* (10-17 cm.), whereas with white light smaller specimens (3-6 cm.) predominate.
- (4) The following species have been found to be attracted: *Mugil*, *Hemiramphus*, *Caranx*, *Arius*, *Equula*, *Stolephorus*, *Chatoessus*, *Brachirus*, Cuttle fish, *Penæus*, *Palæmon*, *Scylla* and *Nep-tunus*.

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January 22, 1952.

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## THE GENERAL PROPERTIES OF IRON OXIDE SOL

ONE of the most puzzling facts in the case of iron oxide sol, is the apparent variations in the properties of the sol and the contradictory conclusions arrived at even by experienced workers. Thus Judd and Sorum<sup>1</sup> report that iron oxide sols when sufficiently purified obey Burton and Bishop Rule. N. R. Dhar<sup>2</sup> considers that even with the highly purified sols containing a very small amount of chloride, the amount of electrolyte required for coagulation is greater, the greater the concentration of the sol, irrespective of the valency of the coagulating ion. However, Sorum<sup>3</sup> maintains that the sols prepared by him were much purer and therefore his results are correct in respect of the sols prepared by him.

During our investigations connected with membrane equilibrium and conductivity, iron

oxide sols dialysed to different extents were prepared. It was found, in agreement with Judd and Sorum, that only highly dialysed sols have a tendency to obey Burton and Bishop Rule. As dialysis proceeded, the concentration of the attached gegenions per gram of iron oxide, decreased and the gegenions consisted predominantly of ferric ions, e.g., in a partially dialysed sol used in the membrane equilibrium experiment the total gegenions were about 0.307 m.e. of fixed hydrogen ions, and 0.599 of ferric ions, while in comparatively highly dialysed sols used in the conductivity experiment, the corresponding values were 0.068 and 0.2781. In the case of Sorum sols which were very highly dialysed, it is possible that the attached gegenions may consist almost wholly of ferric ions, while in the case of the sol prepared by Dhar, the attached gegenions may be predominantly hydrogen ions. Thus the two sols exhibit different behaviour with regard to the effect of dilution, because they are essentially different in nature.

Further experiments are in progress and the detailed account will be published elsewhere.

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December 12, 1951.

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## STUDY OF A GROUP OF SYNTHETIC 3-METHYL ISO-QUINOLINES FOR THEIR SPASMOLYTIC PROPERTIES

PAPAVERINE has been in use for its relaxor effect on smooth muscles. This effect was attributed to its benzyl isoquinoline group. Several derivatives of papaverine have been synthesised. In most of these compounds there is a methyl group in the 3-position. Of these compounds 3-methyl-6·7-methylene-dioxy-1·3-pyridyl-isoquinoline is claimed to be a good substitute for papaverine. It has been noticed that the 3-methyl-isoquinoline compounds, as a rule, are less toxic than the 3-unsubstituted analogues. We had occasion to study a number of 3-substituted isoquinolines synthesised by B. R. Pai (of the Presidency College, Madras) for their spasmolytic property. Seven compounds were prepared and their chemical structures are given below:

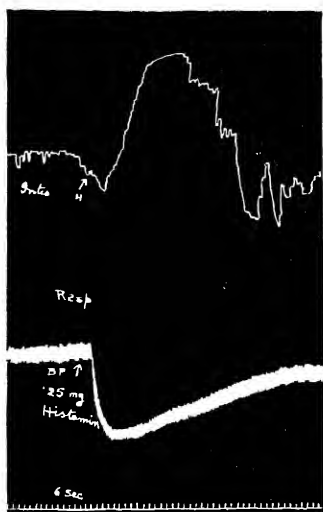


FIG. 1

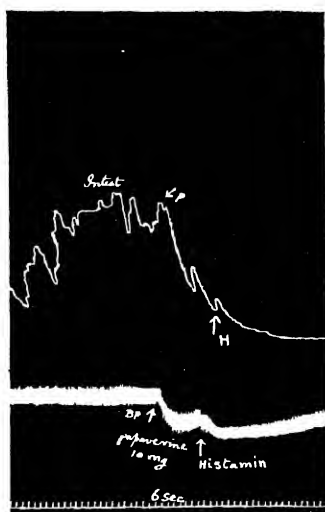


FIG. 2

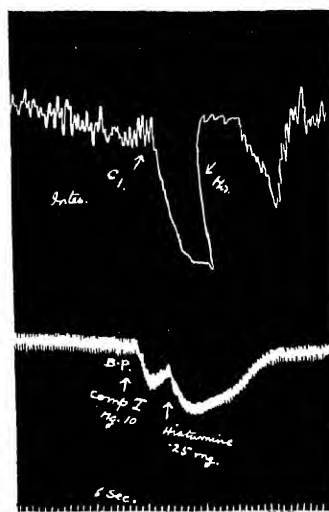
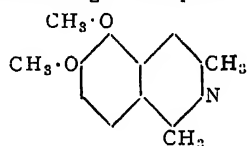
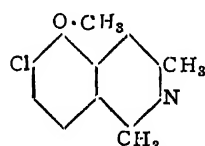


FIG. 3

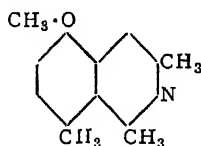
Record of Blood Pressure and Intestinal movements in a dog to illustrate (1) the spasmogenic property with .25 mg. of histamine; (2) the annulling effect of 10 mg. of Papaverine with .25 mg. of histamine; (3) the annulling effect of 10 mg. of Compound I with .25 mg. of histamine.



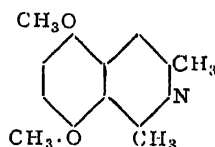
I: 1,3 dimethyl-5,6-dimethoxy isoquinoline.



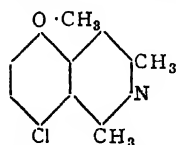
VI: 1,3-dimethyl-5-methoxy-6-chloro isoquinoline.



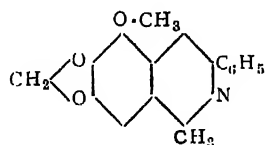
II: 1,3-8-trimethyl-5-methoxy isoquinoline.



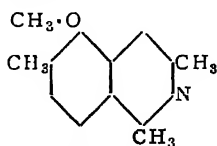
VII: 1,3-dimethyl-5,8-dimethoxy isoquinoline.



III: 1,3 dimethyl-5-methoxy-8-chloro isoquinoline.



IV: 1 methyl-3-phenyl-5-methoxy-6,7-methylene dioxy isoquinoline.



V: 1,3,6-trimethyl-5-methoxy isoquinoline.

The experiments were performed on dogs. Histamine was used to produce spasm, as it is known that most spasmolytics exert their action better when a state of spasm exists rather than on normal smooth muscle. Intestinal movements were recorded with the aid of Jackson's enterograph. The object of our study was (1) to observe the action of these synthetic compounds in counteracting the spasm induced by histamine on the intestines and (2) to compare their potency with papaverine. It was found that 10 mg. of papaverine was able to counteract the effect of 0.25 mg. of histamine; an attempt was then made to compare the potency of the synthetic compounds, under our study, with papaverine.

Compound I, dose per dose, compares favourably with papaverine. Compounds II to VI had no effect on the intestinal tone. Compound VII in the same doses as Compound I was able to relieve the spasm of the intestine, produced by histamine, partially. Higher doses could



not be tried as the quantity supplied was not sufficient. The examined compounds were thus not superior to papaverine in spasmolytic property though Compound I was as effective as papaverine.

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#### CIRCULAR PAPER CHROMATOGRAPHIC ANALYSIS OF THE AMINO ACIDS OF TEA AND COFFEE INFUSIONS

THE circular paper chromatographic technique<sup>1</sup> recently developed in our laboratories has been applied to the separation and identification of amino acids present in tea and coffee infusions. The extract was prepared by adding 50 c.c. of boiling water to 5 gm. of the material and filtering after about 30 minutes. The filtrate was spotted before and after hydrolysis with 6 N HCl. The chromatogram illustrated in the figure shows ten arcs well separated from each other, each containing one or more amino acids. The strongest arc (No. 7) in the chromatogram



Circular paper chromatogram showing the separation of amino acids present in tea infusion.

T—tea infusion without any treatment.  
HT—tea infusion after hydrolysis with 6 N HCl.  
ET—tea infusion after ether extraction.

which occupies a position very near to tyrosine is probably the mono ester of glutamic acid,

provisionally identified by Consden and Gordon<sup>2</sup> and Roberts and Wood<sup>3</sup> in the juice of fresh and withered tea leaves. By running several mixed circular chromatograms<sup>1</sup> with known amino acids simultaneously with tea extract and by iono-phoresis and specific tests the presence of aspartic acid, glutamic acid, leucine (and iso-leucine), phenyl-alanine, valine, alanine, serine, asparagine, tyrosine, arginine, histidine, lysine and proline have been identified in tea infusion. The presence of other amino acids reported by Roberts and Wood<sup>3</sup> have not been identified with assurance by us.

The identity of arc No. 7 as a mono ester glutamic acid was established by the following tests:

- (1) On acid hydrolysis of the tea infusion, the intensity of this arc (No. 7) decreases considerably with simultaneous increase in the intensity of the arc No. 5 relating to glutamic acid and very slight increase in the intensity of arc No. 4 relating to aspartic acid, without altering the intensity of other arcs. This indicates that the substance is of the nature of an ester of glutamic acid. The increase in intensity of the arc No. 4 on acid hydrolysis is due to the conversion of asparagine into aspartic acid.
- (2) On subjecting the tea infusion to iono-phoresis and running a mixed chromatogram of the solutions contained in the cathode, anode and central chambers, it was found that the substance producing arc No. 7 was present only in the central chamber.

It is interesting to note that coffee infusion was found to contain very insignificant amounts of amino acids compared to tea infusion.

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# DEAMINATION OF AMINO ACIDS BY VIBRIO CHOLERAÆ

STUDY of the enzymic make-up and metabolism of vibrios may throw some light on the pathogenicity of *Vibrio cholerae* and also the inter-relationship, if any, among the various types of vibrios. Very little attention seems to have been paid so far to this aspect. A systematic study of the endo- and exo-cellular enzymes of *Vibrio cholerae* has therefore been undertaken. Since deamination<sup>1</sup> is the normal metabolic process by which micro-organisms growing in an alkaline environment utilise the amino acids of the medium, the deaminases have been studied first.

Deamination by cholera vibrios was studied by the technique of Stephenson and Gale.<sup>2</sup> Twenty-four-hour growth of the organism on agar slopes (pH 8.0) was harvested with 0.85% sodium chloride solution and, after centrifuging, washed once with saline and re-centrifuged. The residue was suspended in saline and adjusted to a turbidity equivalent of 40% transmission in a Lumetron Model 'A' Photoelectric colorimeter, using Red filter 650 m $\mu$ . 1 ml. of suspension was shaken for one hour at 38° C. with 1 ml. of 3 M/250 amino acid and 1 ml. of phosphate buffer of appropriate pH value. The ammonia liberated into the reaction mixture was estimated by direct nesslerization, keeping adequate controls for the turbidity produced by the cells. Results of some typical experiments on a few amino acids are reported as Q<sub>N</sub> in the following Table :

TABLE I

Deaminase activity of different strains of vibrios. Activity expressed as Q<sub>N</sub>\* for 1 ml. suspension.

No.	Organism	Amino acid					
		Aspartic acid pH 8.0	Glycine pH 7.5	Glutamic acid pH 7.5	Lysine pH 7.0	Serine pH 7.0	
1	49514 Ogawa	27.2	4.0	..	..	7.3	
2	123 "	16.0	8.0	..	..	34.4	
3	122 "	55.5	12.8	7.5	5.3	27.0	
4	132 "	67.0	12.8	12.2	7.4	23.5	
5	52 "	79.0	9.6	12.2	7.4	20.8	
6	49514 Inaba	22.4	2.4	..	..	4.0	
7	123 "	12.4	4.0	..	..	15.2	
8	119 "	34.0	6.4	5.3	3.5	10.6	
9	113 "	44.8	6.4	7.6	5.3	15.0	
10	74 "	54.6	10.6	7.6	5.3	12.3	
11	49524 "	56.5	10.6	6.4	2.1	18.1	
12	569B "	67.2	5.3	4.3	2.1	12.3	

\* Q<sub>N</sub> =  $\mu$ l of nitrogen calculated from the corresponding ammonia values.

The results (Table I) show that *Vibrio cholerae* possess deaminases in their enzyme make-up and the rate of deamination varies from amino acid to amino acid and from one strain to another. Among the amino acids studied, arginine, aspartic acid, glycine, glutamic acid, lysine, serine and threonine were deaminated. Aspartic acid and serine showed maximum activity. Activity on alanine, phenylalanine, leucine, histidine, methionine, tyrosine, tryptophane and valine was negligible. Deamination was found to be strictly aerobic as would be expected from the fact that the organism itself is highly aerobic. The optimum pH of action was in the range of 7-8 for the amino acids studied. Various factors influencing the activity of deaminases and the relation of the former to the enzymes responsible for synthesising amino acids in vibrios are under investigation.

The interesting feature observed in these studies was that, in general, the Ogawa sub-types showed higher deaminase activity than the Inabas, and this is clear from the differences between the activities of the Ogawa strains 123 and 49514 and the Inaba sub-types derived from them.<sup>3</sup> This aspect of the change of enzyme activity during the transformation of Ogawa into the Inaba sub-type is under further study.

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February 29, 1952.

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## INTESTINAL THIAMINE SYNTHESIS AS INFLUENCED BY DIETARY LEVELS OF PROTEIN

RECENTLY, bacterial synthesis of vitamins in the intestinal tract of the animal host, has received considerable attention.<sup>1,2,3</sup> The intestinal flora seem to be modified by the ingredients of the diet. While the effects of carbohydrate,<sup>4-6</sup> fat<sup>7</sup> and minerals<sup>8</sup> on the intestinal synthesis of vitamin B<sub>1</sub> have been fairly well investigated, the role of protein in influencing the synthesis has not been systematically studied. Our experimental observations in re-

gard to the effect of different dietary protein levels on the intestinal synthesis of thiamine are presented and discussed in this communication.

Three groups of young albino rats (weighing from 40-50 gm.), each consisting of 6 animals, were depleted of their body stores of thiamine by giving them a thiamine-free diet for 3 weeks, when visible symptoms of thiamine deficiency were observed. They were then given 5, 15 and 40 per cent. respectively of vitamin-free casein incorporated in a diet which consisted, in addition to the protein, of maize starch, coconut oil at 10 per cent. level and McCollum and Davis' salt mixture. All the vitamins of the B group, except B<sub>1</sub> and vitamins A and D were supplied in adequate amounts to the rats and the experimental procedure followed that described in earlier experiments of the authors.<sup>9</sup> The average values for the thiamine excretions and storage levels of thiamine (per animal) are presented in Table I.

TABLE I

% Protein in diet	Total weekly excretion of Thiamine		Total body stores of thiamine at the end of the experi- ment in $\gamma$
	In urine $\gamma$	In faeces (dry basis) $\gamma$	
5	0.31 $\pm$ 0.0012	0.37 $\pm$ 0.001	0.11 $\pm$ 0.0007
15	0.16 $\pm$ 0.0014	0.20 $\pm$ 0.0004	0.10 $\pm$ 0.0004
40	0.15 $\pm$ 0.0002	0.24 $\pm$ 0.0008	0.08 $\pm$ 0.0001

The results indicate an increased excretion of thiamine by the group of rats fed 5 per cent. casein, as compared with the other two groups receiving higher percentages of casein. That the increased excretion cannot be due to a greater depletion of the body stores in this group of rats is borne out by the results on the body stores of all the three groups of rats at the end of the experiment. It would therefore appear that the higher excretion by the low casein group of rats is due to increased intestinal synthesis.

We are indebted to Prof. K. V. Giri and Dr. S. S. De for their kind help during the investigation.

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February 1, 1952.

\* It may be mentioned here that one rat on 40% casein diet and two animals on 15% casein diet, died

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### INFLUENCE OF DIETARY SUPPLEMENTATION OF MILK AND CURD ON THE INTESTINAL SYNTHESIS OF THIAMINE IN RATS

THE types of bacteria developing in the intestines and helping the animal host in synthesising vitamins seem to be pronouncedly modified by the nature of the diet.<sup>1,2</sup> It was therefore felt desirable to study the nature of bacteria that develop in the intestines and the effect of these on the synthesis of thiamine when milk and curd are included in the diet. Our experimental observations are recorded in this communication.

Three groups of young albino rats (weighing from 40-60 g.) six in each, were given a basal diet (consisting of vitamin free casein, maize starch, coconut oil, and salt mixture) free from thiamine. The control group was given 3  $\gamma$  of pure vitamin B<sub>1</sub> (in solution) per rat per day. Group A rats were supplied the same amount of vitamin B<sub>1</sub> through 8.5 c.c. of milk and group B rats through 8 g. of curd.<sup>3</sup> All the other B-complex vitamins and Adexolin were supplied to the rats in adequate amounts.<sup>4</sup> After a preliminary feeding for 3 weeks, 2 separate weekly urinary and faecal collections were made and analyses of the weekly urinary and faecal thiamine excretions were carried out employing the thiochrome procedures (using Lumetron Fluorimeter) described by Mawson and Thompson<sup>5</sup> and 'Methods of Vitamin Assay' by the Association of Vitamin Chemists-1947 respectively.

At the end of this metabolism period, 3 rats from each group were killed and their total thiamine stores were analysed by the thiochrome method of Greenberg and Rinehart.<sup>6</sup>

On a different set of rats, consisting of 3 animals in each group, and maintained on the same dietary factors, the faeces were collected

under aseptic conditions and examined for total count, coliform and lacto-bacilli organisms. The results (average) are presented in Tables I and II.

TABLE I

Group	Total weekly excretion of thiamine		Body stores of thiamine $\gamma$	Net increase in weight g/g
	In urine $\gamma$	In faeces (dry basis) $\gamma$		
Milk ..	$0.42 \pm 0.0015$	$1.69 \pm 0.022$	$0.41 \pm 0.0009$	22.3
Curd ..	$0.66 \pm 0.0015$	$2.76 \pm 0.25$	$0.51 \pm 0.0002$	33.7
Pure vitamin	$0.46 \pm 0.0015$	$1.79 \pm 0.018$	$0.45 \pm 0.0001$	21.7

§ during the five-week period.

TABLE II

Group	Total no. per gram of faeces of		
	Bacteria $\times 10^6$	Coliform organisms $\times 10^4$	Lactobacilli $\times 10^6$
Milk ..	9	10	9
Curd ..	31	111	8.3
Pure vitamin	21	31	6

The results (Table I) show that the excretion of thiamine by the rats receiving curd in their diet is higher than in the other two groups. The status of the body stores of thiamine in the 3 groups of rats would serve to eliminate the possibility of greater depletion of the Vitamin B<sub>1</sub> in the curd-fed rats. The possibility that the higher excretion in the curd group may be due to poor absorption of the vitamin B<sub>1</sub> is ruled out by comparison of the growth rate of rats, of the three groups, curd group rats showing the greatest increase in body weight. It would thus seem quite possible that the increased excretion of thiamine by the latter is due to increased intestinal synthesis.

The above consideration is further substantiated by the bacteriological data (Table II). It may be seen that the total count as well as the number of coliform organisms are highest in curd group rats.

Our observations in regard to the type of pre-pondering bacteria are in close confirmation with those of the early workers,<sup>7,8</sup> in that feeding of milk has led to the establishment of lactobacilli.

The authors wish to thank Prof. K. V. Giri and Dr. S. S. De for their keen interest and Dr. M. Sirsi for his kind co-operation in the bacteriological part of the investigation.

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\* Vitamins B<sub>1</sub> and B<sub>2</sub> in 6 milk samples and corresponding curd samples were estimated by the methods of Harris and Wang<sup>4</sup> and Kodicek and Wang<sup>5</sup> respectively. The additional amount of riboflavin supplied by curd was added to the diets of the milk and control group rats.

† Each rat received daily the following amounts of vitamins.—50  $\gamma$  of riboflavin, 50  $\gamma$  of calcium pantothe, nate, 10  $\gamma$  of nicotinic acid, 10  $\gamma$  of pyridoxine and 1 mg. of choline. Each rat was given two drops of adexoline twice a week.

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### LEAF SHAPE EXPRESSION IN NEW WORLD COTTON HYBRIDS BETWEEN WILD DIPLOIDS AND CULTIVATED TETRAPLOIDS

STEPHENS<sup>2</sup> furnished adequate data in support of his hypothesis that the leaf-shape continued to change from node to node until the commencement of flowering phase which put a stop to such variations from the stage of the climax leaf production. The hypothesis, however, did not come out true in the case of hexaploids and triploids produced through crossing wild and cultivated American cotton varieties.

Work on the synthesis of new tetraploids through crossing American wild diploids with cultivated tetraploids was undertaken in 1944 at Coimbatore, mainly with the object of developing fertile types resistant to drought, jassids and blackarm. Diploid *G. raimondii* was used as a parent for effecting crosses with *G. hirsutum* (Coimbatore type 4463) and *G. barbadense*

(Sea Island type V 135) The sterile triploid (*G. raimondii* × *G. hirsutum*) was doubled with colchicine to produce fertile hexaploid which in turn was crossed with cultivated Americans for obtaining new tetraploids. The leaf-shape development in the triploids and hexaploids was very characteristic in the fruiting branches and different from the normal behaviour recorded in *Gossypium* so far. The main changes noticed in the parents, the triploids and the hexaploid are illustrated in the Plate. The hypothesis fitted *in toto* when applied to the three parents, viz., *G. hirsutum*, *G. barbadense* (not included in Plate) and *G. raimondii* but not to the tri-

*mondii* was apparent from the increase in measurement 'L' (length of the median from centre of Callus spot to tip) and reduction in 'W' (maximum width of median).

In the examples cited by Stephens demonstrating the dominance resulting from threshold effects, the ultimate phenotypic expression of alleles was shown to depend on two variables, viz., (a) dosage—controlled by genotypic background. The occurrence of entire leaf in flowering branches at all nodes in triploids and at particular flowering nodes in hexaploid might be viewed as having resulted from the timing action of a gene due to the threshold effects of dominant gene present in *G. raimondii*. The phenomenon points to a very definite evolutionary change which is not clear at the moment.

The author's thanks are due to Sri. V. S. Tanam for the pen and ink drawings.

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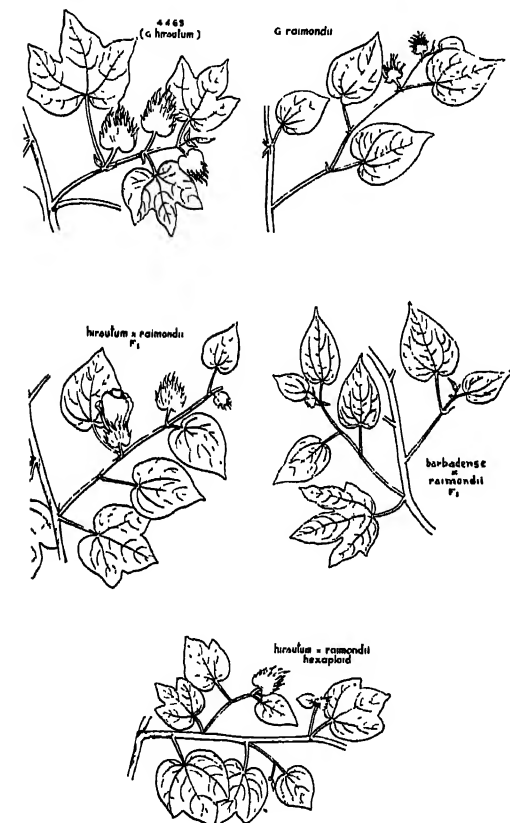
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# STABILITY OF VITAMIN C IN NEERAM FROM DATE PALM AT 37° C. (*Phoenix sylvestris*)

No preservative was added to these samples. The vitamin C content was estimated by titrimetric method with 2,6-dichlorophenolindophenol<sup>1</sup>. The results obtained with 2 samples, the one giving the lowest and the one giving the highest values for vitamin C together with the effect of storage, are given in Table I.

TABLE I

Sample	mg. vit. C/ 100 c.c. neera	
	I	II
Original sample ..	7.14	12.5
Stored at 37° C for		
24 hrs. ..	7.13	12.08
48 hrs. ..	7.04	12.06
72 hrs. ..	6.96	11.97
8 days ..	6.88	11.7
15 days ..	6.84	11.5



pleoid crosses and hexaploids. The leaves on the fruiting branches of the triploids were mostly entire like *raimondii*, the lobed leaf of the tetraploid parent being located on the main stem node subtending the branches. In the hexaploid on the other hand, the entire lobed leaf occurred only at the nodes of the secondary fruiting branches carrying flower buds but not at other nodes. The influence of gene *L*<sup>2</sup> in the shape expression of entire leaves in the triploid between *G. barbadense* and *G. rai-*

It is clear from the above that vitamin C in neera is remarkably stable on storage for even 15 days at the end of which period, more than 90 per cent. of the vitamin is retained. It might be mentioned here that during storage, the pH of neera changed from 7.5 to 3 as a result of fermentation. The stability of vitamin C could not be ascribed to the fall in pH as was shown by incubating pure vitamin C at pH 3 for 15 days, which showed a marked deterioration under our experimental conditions.

The stability of vitamin C in neera may however be ascribed to the presence of SH compounds, as these compounds are known to protect vitamin C from oxidation.<sup>2</sup> The different neera samples all gave a very strongly positive reaction with nitroprusside. The amounts of SH compounds were then quantitatively estimated by iodimetric titration after making necessary correction for the vitamin C content as determined by the indophenol titration. The different neera samples were found to contain from 89 mg to 175 mg of the SH compound per 100 c.c. Further, storage at 37° C. for 72 hrs. had no marked effect on the concentration of SH compounds. Ascorbic acid reductase was also found to be present in the neera samples as detected by Crooks' method.<sup>3</sup> Neera was also found to have marked inhibitory action on ascorbic acid oxidase. Glutathione has been shown to work in conjunction with the reductase and keep vitamin C in a reduced form.<sup>4</sup> Attempts are now being made to isolate glutathione from neera.

Our thanks are due to the Chief Neera Organiser and his colleagues for their kind co-operation.

Dept. of Biochemistry, M. N. GUTTIKAR.  
Institute of Science, KAMALA SOHONIE.  
Bombay 1.  
March 31, 1952.

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#### PADDY-CUM-FISH CULTURE IN RELATION TO PUBLIC HEALTH

IN an earlier review<sup>1</sup> of the Indonesian practices of combined cultivation of rice and fish attention was directed to the fact that in these practices, besides a catch crop of fish, there is also an increased yield of paddy by about 5 to

10%. Both these commodities are needed for improving the nutrition of the people in rice-growing areas. It has often been feared by Public Health authorities that such paddy fields may encourage the breeding of undesirable species of mosquitoes thus endangering public health. Dr. A. E. Hofstede,<sup>2</sup> Inland Fisheries Adviser, Djakarta (Indonesia), has partly met this objection by producing some experimental evidence.

The investigation carried on in the plain of Tjiandjur by Hofstede related to the rate of development of mosquitoes, particularly malaria vectors, in rice fields where fish and rice are cultivated simultaneously. The experiment showed that during 90 days, when the transplanted paddy had sufficient water in the field and fish were growing in association with it, only a few *Anopheles* larvæ were found and even these belonged to non-vector species, such as *A. subpictus*, *A. vagus*, *A. barbirostris*, *A. annularis hercanus* and *A. hercanus*. After 90 days, the paddy vegetation was closed, with the result that full and heavy growth of weeds, especially grass, appeared along the inner sides of the banks of rice fields. It was then that a mass development of the dangerous *A. aconitus* was observed.

Hofstede observes that the experiment "confirms the practical experience of more than one fisheries expert, namely, that up to the 'closing' of the paddy vegetation no serious breeding of *A. aconitus* needs to be feared, so that fish rearing as a catch crop among growing rice may be practised without danger of increasing malaria".

The above is a very important conclusion which should be investigated in other rice-growing countries, particularly in such situations where there are possibilities of growing a fish crop simultaneously with the rice crop. Such investigations will prove of special value in 24-Parganas of West Bengal where vast possibilities of paddy-cum-fish culture exist already. Growing of fish in paddy fields may thus confer an additional benefit by controlling the breeding of mosquitoes and thereby reducing the incidence of malaria.

Museum House,  
Calcutta-13,  
March 26, 1952.

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**PROLONGED LARVAL PERIOD AND  
DELAYED EMERGENCE OF ADULTS IN  
PROCONTARINIA MATTEIANA KIEFF.  
& CECC. (ITONIDIDAE : DIPTERA)**

UNUSUAL prolongation of the larval life is known to occur in many insect species.<sup>1,2,3</sup> The present author, in his studies on the mango leaf gall midge, *Procontarinia matteiana*, observed a similar prolongation of the larval period and subsequent delayed emergence of the adults in several successive batches.

*P. matteiana* has three broods in a year. The first flight is in March and is composed of adults from the overwintering larvæ of the different broods of the previous year, in various proportions. The larvæ of the first generation have a very wide developmental period. Some develop quicker and produce adults in July while in others the larval stage is prolonged considerably and the adults emerge in October or even in March of the following year. The second flight, which is in July, is also a composite one and is made up partially of adults from the larvæ of the previous year's second and third broods and partially of adults from the first generation larvæ of the same year. The larvæ of the second generation too, like the first, do not all develop equally and while some may be well developed and produce flies in October, the others continue as such till March or July of the year following. The third is in October with flies coming mainly from the first and second generation larvæ of the same year. The third generation larvæ overwinter and produce the first batch of adults in March next when general emergence of flies takes place from the overwintering larvæ of the various broods of the previous year. There is some evidence to show that although most of the remaining galled leaves are destroyed at the time of leaf fall in March, some containing larvæ of the second and third generations survive from which the flies emerge in July. Not more than two emergences have so far been observed from the larvæ of the third generation.

The larval period in *P. matteiana* may thus be prolonged from about two months to almost a complete year in the larvæ of the same batch from the eggs laid at the same time and with emergence of adults occurring regularly in two or three batches. It may be worth while mentioning that *P. matteiana* oviposits in tender leaves only and the three flights of the year coincide with the three main periods when the new mango leaves unfold in these parts. The larvæ of different broods are, therefore, present in leaves of different ages.

The exact causes which bring about this very wide fluctuation in the larval period of *P. matteiana*, under the same conditions, have not yet been studied, but the resultant partial and rhythmic emergence of adults, which coincides with new leaf emergence, appears to be a device to overcome the disadvantages inherent in the species. In the first place the duration of the adult life, in which the fly has to complete the oviposition, is only about 48 hours, and secondly, the oviposition, is restricted to the tendermost leaves. Further studies are in progress.

I am grateful to Dr. K. B. Lal for helpful guidance.

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December 20, 1951.

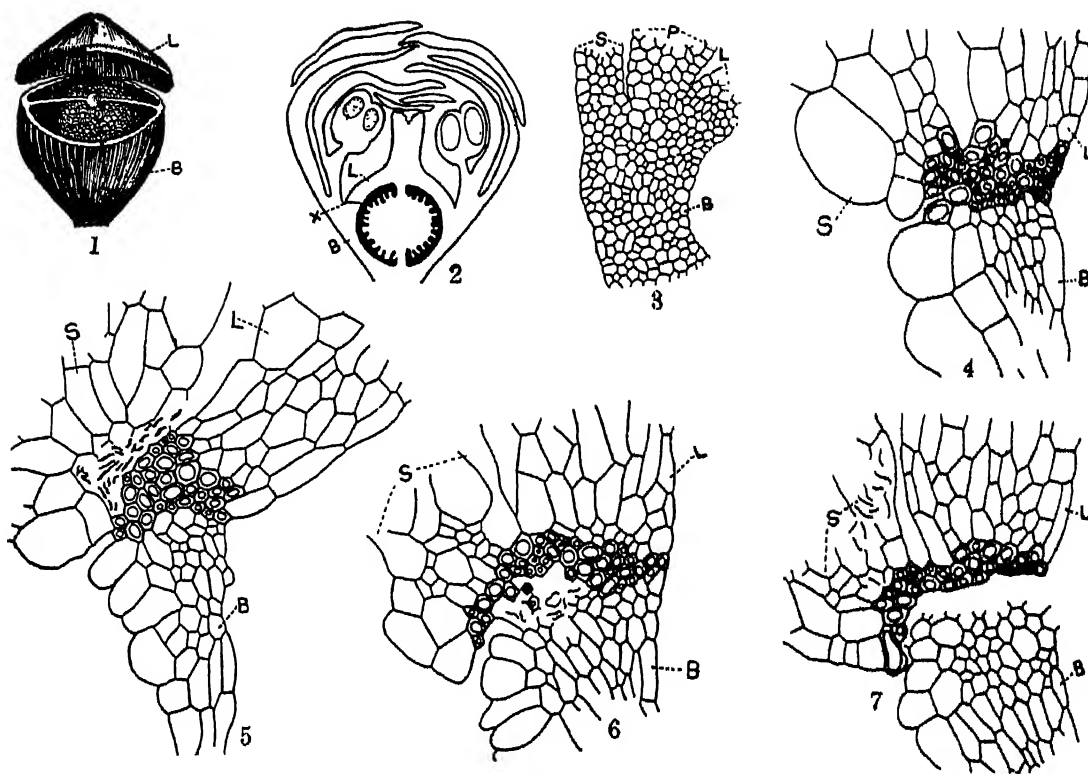
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**CIRCUMSCISSILE DEHISCENCE IN  
SPHENOCLEA ZEYLANICA GAERTN.**

*Sphenoclea zeylanica*, a member of the Campanulaceæ (Sphenocleaceæ, according to Airy Shaw<sup>1</sup>), has a fruit of the nature of a pyxidium (Fig. 1). The ovary is semi-inferior and bilocular with an indefinite number of ovules borne on axile placentæ. The upper portion of the ovary wall is free and this corresponds to the future lid (Fig. 2, L). The lower portion of the ovary wall which is fused with the remaining basal parts of the flower, forms the base (B) of the fruit.

The wall of the young ovary is made up of ten to fourteen layers of uniform thin-walled parenchymatous cells (Fig. 3). At a later stage, however, the inner cells in the lower region or the base, gradually disorganize so that it becomes narrower. In the mature fruit the lid comes off in a circumscissile manner from the base, at the region marked X in Fig. 2. In this region a group of transversely arranged cells gradually become lignified. The extent of the lignified cells is shown in Figs. 4 and 5.

In a fairly old fruit, at a stage when the dicotyledonous embryo is organised in the seed, some of the thin parenchymatous cells in the upper portion of the base and lying immediately below the group of lignified cells, show gradual signs of degeneration (Fig. 6). This degeneration extends to either side (Fig. 7) with the result that the lid gets detached from the base



FIGS. 1 to 7

FIG. 1. Mature pyxidium; FIG. 2. L. S. young flower bud,  $\times 20$ ; FIG. 3. L. S. left side of young ovary wall,  $\times 100$ ; FIGS. 4 and 5. Stages in the organization of lignified cells,  $\times 135$ ; FIGS. 6 and 7. Stages showing the gradual degeneration of cells of the base lying immediately below the group of lignified cells,  $\times 135$ . B = Base; L = Lid; P = Petal; S = Sepal. in a circumscissile manner all round (Fig. 1). Finally, the lid drops off exposing a large number of brownish black seeds in the centre of the base (Fig. 1). The opening of the lid may also be due at least partially to the pressure exerted by the enlarging seeds.

Recently, the anatomy of circumscissile dehiscence has been described in *Hyoscyamus niger*, *Portulaca grandiflora*, *Plantago major*, *P. maritima* and *P. pusilla* by Rethke<sup>3</sup> and in *Anagallis pumila* by Raju<sup>2</sup>. The mechanism of dehiscence in these forms, however, is slightly different from that described in the present form. The final stage of dehiscence in *Sphenoclea zeylanica* approaches closely the condition described by Rethke<sup>3</sup> for *Hyoscyamus niger*. But in *Hyoscyamus niger* the ovary is superior and its inner and outer epidermal layers become heavily lignified.

Our sincere thanks are due to Prof. P. Maheshwari for valuable suggestions, and Prof. L. N. Rao for encouragement.

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April 7, 1952.

K. SUBRAMANYAM  
M. V. S. RAJU.

1. Aitry Shaw, H. K., *Flora Malesiana*, 1948, 4, 27-28.
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#### ABNORMAL LEAVES OF *CYCAS REVOLUTA* THUNB.

CERTAIN abnormal rachises in cultivated female specimens of *Cycas revoluta* which form the topic of the present investigation were found to be remotely similar to those described by Le Goc.<sup>1</sup> Serial sections were cut to study the disposition of tissues.

The abnormal rachis showed an upper folding of tissues and differentiation of a 'subsidiary rachis'. This was formed mainly by the bulging and pronounced development of the



upper bract-like portion of the principal rachis. Subsidiary leaflets were arranged in a spiral manner in contrast to the opposite arrangement of the normal leaflets (Fig. 1).

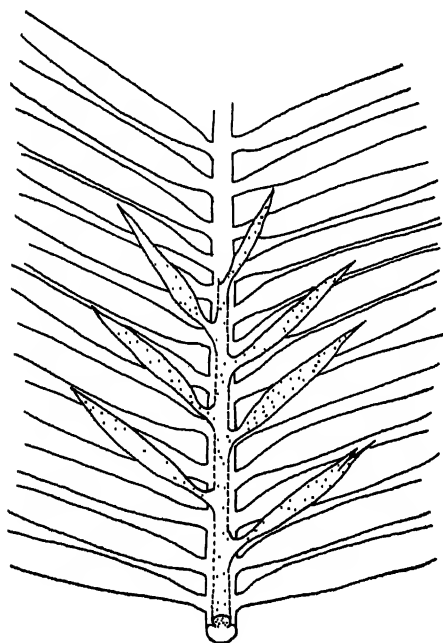


FIG. 1. *Cycas revoluta* Thunb. Upper portion of an abnormal leaf to show the subsidiary rachis (dotted) and subsidiary leaflets (dotted).

The subsidiary leaflets were formed by a

gradual process of elongation and constriction. The differentiation of a transfusion tissue served to hasten the formation of leaflets. The supply of leaflets was also formed by a division of the bundle of the subsidiary rachis. The xylem of the foliar bundle showed a clear mesarch condition.

The total length of the subsidiary rachis did not exceed 7 cm in the several specimens examined and the subsidiary leaflet was usually 3.0 cm in length.

The organisation of the subsidiary leaflet was similar to that of the normal leaflet but tissues were condensed to fit in a far smaller space.

Goebel's<sup>2</sup> contention that 'the pinnules in the middle region of the leaf appear before the upper and under ones', appears to be confirmed by this study.

My sincere thanks are due to Professor Shri. Ranjan for encouragement and laboratory facilities. To Mr. G. P. Agarwal and Mr. B. B. S. Raizada, I am grateful for help in the preparation of sections.

Botany Dept., RAMESH KUMAR SRIVASTAVA,  
University of Allahabad,  
Allahabad,  
January 25, 1952.

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# FORTHCOMING INTERNATIONAL SCIENTIFIC AND TECHNICAL CONFERENCES

Date	Subject of Conference	Organised by	Location
July 4-6	.. Joint Commission on high Altitude Research Stations, I.C.S.U.	Secretary, Dr. R. Stämfl, Bülhlplatz 5, Berne, Switzerland	Denver, Colorado
July 7-11	.. Symposium on Evolution	Dr. R. Brown, Society for Experimental Biology, Botany Department, Leeds University, Leeds	Oxford
July 9-14	.. 6th International Congress of Animal Husbandry	Secretariat, European Association for Animal Production, c/o Ministry of Agriculture, Copenhagen	Copenhagen
July 14-19	.. International Congress of Physical Medicine	Hon. Secretary, Dr. A. C. Boyle, 99, Harley St., London, W. 1	London
August 11-21	.. International Scientific Radio Union—General Assembly	Secretary, Mon. Eng. E. Herbays, International Scientific Radio Union, 42, rue des Minimes, Bruxelles	Sydney, Australia
Sept. 1-3	.. 3rd International Spectroscopy Colloquium	Secretary, E. Van Someren, Industrial Spectroscopy Group of the Institute of Physics, 47, Belgrave Square, London, S.W. 1	London
Oct. 24-25	.. Symposium on Chemical-Biological Co-ordination	The Secretary, Chemical-Biological Co-ordination Center of the National Research Council, 2101, Constitution Avenue, Washington, D.C.	Washington, D.C.

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## REVIEWS

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**Astrophysics. (A Topical Symposium).** Edited by J. H. Hynek. Astronomical Series. (McGraw Hill), 1951. Pp. 703. Price \$12.00.

The book under review is a commemoration volume planned on the occasion of the fiftieth anniversary of the famous Yerkes Observatory of the University of Chicago (founded in 1897), and is in the nature of a topical symposium of 14 papers presented by outstanding workers reviewing the progress in the active branches of astrophysics during the past 50 years.

The Editor's aim has been "to address a hypothetical first year graduate student well versed in fundamentals but by no means a specialist". The subject-matter is divided into four sections: (i) Spectroscopic astrophysics; (ii) The Physics of the Solar System; (iii) The Physics of Binary and Variable Stars; and (iv) The Physics of Cosmic Matter. The book opens with an "Introduction" by Bengt Ström-gren, giving a brief account of the astrophysical ideas prevalent about the beginning of this century. This forms an appropriate background against which the growth of knowledge during the past five decades can be viewed in its proper perspective.

The first five chapters covering more than a third of the book are devoted to Spectroscopic Astrophysics. A short account of the classification of stellar spectra and its physical significance by P. C. Keenan and W. W. Morgan is followed by a fairly detailed and lucid exposition of the interpretation of normal stellar spectra by Lawrence W. Aller. In the next chapter Otto Struve deals with the analysis of peculiar stellar spectra, a field in which he has done pioneering work. An excellent survey of the role played by molecules in the spectra of astronomical bodies by P. Swings contains a long list of problems of an experimental and theoretical nature awaiting solution. The last and longest chapter of this section is the masterly survey by Bengt Ström-gren of 'The Growth of Our Knowledge of the Physics of the Stars' during the present century.

The second part of the book deals with 'The Sun and Stellar Radiation' (Edison Pettit), 'Comets' (N. T. Bobrovnikoff) and 'On the Origin of Planets' (Gerhard P. Kuiper). Kuiper's conclusion that "the present developments indicate that the process of planetary formation

is but a special case of the almost universal process of binary star formation" sums up the present status of a long-standing problem.

The third part dealing with Binary and Variable Stars, both of which occupy a place of great importance in Astronomy, has four contributors. G. Van Biesbroeck discusses 'Visual Binaries and Stellar Parallaxes', J. A. Hynek deals with 'Spectroscopic Binaries and Stars with Composite Spectra' and Newton L. Pierce with 'Eclipsing Binaries'. The chapter on 'The Intrinsic Variable Stars' has been contributed by Cecelia Payne-Gaposchkin.

'Physics of Cosmic Matter' contains two chapters. The first by Jesse L. Greenstein deals with 'Interstellar Matter' in its various aspects and its significance in stellar evolution. The last chapter of the book entitled: 'The Structure, the Composition, and the Source of Energy of the Stars' by S. Chandrasekhar gives an excellent survey of a field of astrophysics in which advances in knowledge have come largely from the theoretical side.

The reviewer feels that the inclusion of selected photographs of stellar spectra in Chapter I, illustrating the significance of the spectral sequence would have been valuable. Again, Chapter 6 dealing with the sun could have been amplified to give a more detailed account of those aspects of the physics of the sun which are either just touched upon or not referred to at all. There is, for instance, no mention of the Evershed Effect in sunspots.

The beginner in the field of astrophysics finds that there are few books which suit his requirements. The majority of books available are either too popular or too specialised. The book under review bridges this gap. The careful reader will find almost every chapter stimulating and thought-provoking. It is indeed a very valuable addition to astrophysical literature.

R. ANANTHAKRISHNAN.

**Laboratory Instruments: Their Design and Application.** By A. Elliott, Ph.D., and J. Home Dickson. (Chapman & Hall Ltd., London), 1951. Pp. 414. Price 32 sh. net.

The book is intended to provide in a concise form relevant information useful to workers

for the design and fabrication of experimental set-ups and instruments. The book is prefaced by a descriptive statement of the factors which influence the design of measuring instruments in general. The intelligent reader is expected to work out for himself the details of any particular design in which he is interested, in the light of the information provided.

The book can be conveniently divided into two parts. The first part consisting of eleven chapters deals with general design principles together with the kinematics of design. The first chapter discusses the accuracy of machining operations indicating the tolerances obtainable with specific tools. The second chapter deals briefly with the properties of various types of wood, steel, alloy steels, copper and aluminium alloys and after summarising the various properties in a table goes over to the consideration of plastic materials and materials for springs. A useful table on the strength of silica fibres is provided. The third and the fourth chapters give a brief account of the fundamentals of workshop practices like casting and welding of metals, information on screws and rivets and the preparation of drawings for the workshop. The fifth is a good chapter on the kinematics of constraints and couplings. The sixth chapter deals with the methods available for the measurement of small displacements and refers briefly to Tolansky's work on multiple beam interferometry. Sensitivity of instruments and systematic and other errors are considered in a general manner in the next chapter while the eighth chapter deals pretty exhaustively with the methods for producing vibrationless supports. An account of the recent work of Haringx on the design of antivibration mountings is given in this chapter for a body having one degree of freedom. A chapter on damping of instruments followed by one on the tests for flatness, straightness and squareness concludes the first half of the book dealing with mechanical design.

The second part, which consists of five chapters but comprises more than half of the volume, is devoted to the properties of glass, the working of glass, lenses, mirrors and prisms, description of optical instruments and finally photography in research. Ray tracing methods are indicated in an appendix and references to literature are given for the benefit of those who require further details. The chapters on properties of glass and the methods of working glass are exceptionally complete and contain many useful practical hints, tables, charts and

diagrams. The chapters on lenses, mirrors and prisms and optical instruments are also exhaustive with copious illustrations and tables, but at the same time clear and concise. The chapter on photography is brief in comparison, but deals with many useful topics, especially optical filters.

The discussions in the book are mainly physical without going into the details of actual design. Selected references are given at the end of each chapter for further reading, many of which are quite recent. As a whole, this book will be of great help to scientists in India who are usually handicapped by inadequate training in the design and construction of instruments. As most of the data compiled in this book are usually scattered in journals and manufacturers' catalogues, this book with its clear, logical and precise style and absence of unnecessary details would certainly go a long way in indicating the principles on which a good design can be based and help in appreciating the limitations of the instrument so designed. Throughout the book, discussions are interspersed with extremely useful and interesting practical details from the authors' experience.

A discussion on the merits and demerits of dark room safe lights used in the processing of photographic films and plates should have been added in order to make the chapter on photography sufficiently complete. The reviewer also feels that presentation of some information on ferromagnetic alloys and their working and the design of high vacuum equipments would have added to the value of the book.

The book is well indexed and well illustrated and the printing and binding are excellent. The price, however, appears to be a little too high.

D. L. BHATTACHARYA.

**The Magnetron.** By R. Latham, A. H. King and L. Rushforth with a Foreword by L. J. Davies. (Chapman & Hall, London), 1952. Pp. x + 142. Price 18 sh. net.

This book is written by persons who took part in the development and manufacture of the magnetron. The book is divided into fourteen chapters. The basic idea of the radar, V.H.F. oscillators, the development of the multi-resonator magnetrons, properties of the anode block, extraction of energy from the magnetron, the electronic theory, cathodes, constructional technique and manufacture performance testing and application of magnetron to radar come

up for separate treatment. There are valuable references to original literature. There is a good name and subject-index.

Every chapter is most lucidly written and it is indeed a delight to read through the book. The subject-matter is quite authentic and so selected as to cover the fundamental ideas clearly and completely. The printing and get-up is excellent. The diagrams and photographs are aptly chosen. In brief, the authors have succeeded in treating this important and fascinating subject completely in the short space of 142 pages. The price (18 sh.) is not high considering the value of the work.

The book will serve as a text to all students of electrical and communication engineering and Honours students in physics. Also, it will be a useful addition to every engineering and science college library.

S. V. CHANDRASEKHAR AIYA.

**The Lipids: Their Chemistry and Biochemistry. Vol. I: Chemistry.** By Harry J. Deuel Jr. (Interscience Publishers Inc., New York), 1951. Pp. xxiv + 982. Price \$ 18.50.

This book is the first of two volumes on lipids dealing with their chemistry only; volume II is to concern exclusively with biochemical and nutritional aspects. Earlier monographs relate only to certain of the components included under the general classification of lipids; Hil-ditch's recent treatise on "The chemical constitution of natural fats" (1947) is an example. Prof. Deuel has now made a comprehensive survey of present knowledge concerning the chemistry of all lipid-like compounds associated with animal and plant tissues; emphasis has been on those of animal origin. The work is also "intentionally slanted" from the point of view of a biologist.

The volume comprises ten chapters the first five of which are devoted to simple and conjugate lipids while the rest deal with vitamins belonging to the class of derived lipids. Chapter I commences with definitions and classification of lipids. Chapter II deals with the chemistry of fatty acids and glycerol. The chemistry of neutral fats is discussed in Chapter III. Chapter IV describes waxes, higher alcohols including sterols, triterpenes, glyceryl ethers, coloured fats and hydrocarbons. Chapter V presents the chemistry of the biologically important group of compounds: phosphatides and cerebroside.

The treatment in each chapter includes classification and nomenclature, distribution

and properties, composition and synthesis. The chapter on glycerides outlines critically the various theories that have been advanced to explain the glyceride composition of fats and oils.

The latter five chapters of the monograph give an extensive account respectively of the carotenoids and related compounds, vitamins A, provitamins and vitamins D, vitamins E and vitamins K. Among the various topics that have been dealt are those relating to occurrence, chemistry, structures, properties including spectral, stereochemical and chromatographic behaviour, optical rotation and solubility. A noteworthy feature of the chapter on vitamin A is an account of twelve known syntheses of the vitamin and related compounds.

Each one of the chapters represents a careful and thorough evaluation of the progress in the subject covering almost the entire literature. The practical methods for synthesis, separation, purification and analysis are described to the extent necessary for a complete understanding of the subject. A feature of the book is the discussion of all lipid-like materials in animal tissues. Among the interesting biological problems dealt with may be mentioned those dealing with toxicity of synthetic fats, structure of fatty acids as related to antileprosy action and chemical structure in relation to biological activity of vitamins E, K and like compounds.

The treatise is throughout extensively supported by references to literature and profusely illustrated with graphs, tables and photographs. In addition to the usual author and subject indices, a special section is devoted to generic names of plant and animal sources from which lipids are derived. The volume constitutes an invaluable reference book to all concerned with the study of this wide group of substances.

A. SREENIVASAN.

**Sugar Industry in India and Abroad.** By Prasanna Chandra Goswamy, Cotton College, Gauhati, 1951, Pp. 72. Price Rs. 3.

In view of the recent history of sugar manufacture and distribution in India, some salient and highly significant facts brought out by this pamphlet deserve serious thought by both by the industrialists and the government.

India has been the original home of the sugar-cane, but sugar is dearer in India than in England and U.S.A. where it costs only 5 d, a pound and 9.75 cents respectively,

The factories have made huge profits throughout these years but most of them have not modernised their equipment or introduced new techniques to improve efficiency of production.

Despite agricultural research, the yield of cane has not improved, the average having remained all these years at 14 tons per acre in India, as against 65 tons in Hawaii, 56 tons in Java and 41 tons in Peru. One reason for this lies in the location of farms in the least climatically suitable regions for sugarcane cultivation like U. P. and Bihar which have the largest acreage, and possess 106 factories, while the more suitable regions like Bombay and Madras have lower acreage and possess only 31 factories. The logical step would be to extend sugarcane cultivation in the latter region where the yield is 2 to 3 times that in U. P. This has not yet been taken up in earnest. The author advocates Assam and Bengal, too, as regions suitable for establishing more factories. India needs to produce over at least three million tons of sugar in addition to the present production of gur. This can be done only if the acreage of sugarcane is increased in the Deccan. For this purpose, the first essential is that irrigation facilities have to be gradually but quickly extended.

In the interests of all concerned, sugarcane prices must be reduced to normal levels and imports of sugar, too, allowed in order to bring down sugar prices. Also, Indian manufacturers should be encouraged to manufacture all the equipment needed within the next ten years.

The author makes valuable suggestions to bring Indian technical and agricultural efficiency on a par with foreign practice, and eminently deserves to be congratulated for compiling this thought-provoking booklet.

Y. K. RAGHUNATHA RAO.

**Studies on the Natural Fats.** By A. R. S. Kartha. (Published by the Author, Department of Chemistry, Maharaja's College, Ernakulum), 1951. Vol. I, Parts I-II. Pp. 143. Price Rs. 5. Vol. II, Part IV. Pp. 111. Price Rs. 2.

After a critical appraisal of well-established methods of analysis, the author describes modified methods of his own for the determination of the glyceride structure of fats. Analytical data on some 26 fats examined by him are given. The author then questions several well-known theories such as Hilditch's rule of 'even distribution' enunciates hypotheses of his own to the effect that fatty acid formation is governed almost entirely by their heat content and that unsaturated acids are synthesised

to a large extent for their "fluidising" purposes, applies same to various fields of metabolism like seed fats and milk fats and evolves interesting theories of his own. In Volume II, Part IV, he further develops his theory of "fluidisation", discusses the mechanism of formation of depot fats and provides explanations for various physiological phenomena connected with fat metabolism.

The new theories are no doubt attractive and worth serious consideration by others. But it is felt that a less dogmatic presentation would have enhanced their value a great deal.

Also, due to the reading matter being strung together without proper spacing, the use of too many abbreviations, and poor printing, the volumes prove none too easy reading. They certainly deserve better printing and publishing.

S. A. S.

**Facts, Files and Action in Business and Public Affairs.** (Part I, *Sources and Backgrounds of Facts*). By J. Edwin Holmstrom. (M/s. Chapman & Hall), 1951. Pp. xvi + 449. Price 36 sh. net.

The book under review is the first of a series of three intended by the author to assist the planner and the man of business 'in the art of getting things done'. As the comprehensive title indicates, Part I is in the nature of a source book, covering a wide range of subjects and giving under each heading, in engagingly essay form, broad outlines of the subject for the easy comprehension of the non-specialist in the field.

The subjects have been arranged alphabetically, while the reference numbers start afresh on each page. This has the double advantage of avoiding footnotes and enabling the Bibliography given at the end to be used also in reverse.

The volume would indeed serve as an excellent model to any who wish to compile a similar one on Indian Institutions as comprehensively and yet as compactly, as the author has been able to achieve, with special reference to British Institutions.

**Science in the School Garden.** By Mary A. Johnstone. (Macmillan & Co. Ltd., London), 1951. Pp. xiv + 176. Price 4 sh. 6 d.

Miss Johnstone's well-illustrated and excellently-produced little volume is addressed to the children of primary schools and lower forms of secondary schools in England, and succeeds

eminently in its object of enabling young minds to look at the phenomena happening in and around a school garden with a scientific habit of mind. Objective account of the structure, growth and function of living and non-living things are skilfully interwoven with the author's personal observations so as to produce just the right tone which, as children, we have all learnt to love. The book can be heartily recommended to the young ones in our country who have learnt to think and feel in English.

**Physical Properties of Some Samples of Asbestos-Cement Siding.** By Cyrus C. Fishburn. U.S. Dept. of Commerce. Building Materials and Structures Report 122.

The pamphlet has five sections, of which the first two are general in character. The third section deals with standard tests on specimens. The tests include different methods of measuring the thickness, linear expansion on exposure to high pressure steam, linear change in wetting and drying water absorption, flexural strength and extensibility under flexural load including strength, extensibility and modulus of elasticity. Section four deals with the standard tests conducted by the British Building Research Board which include (i) Flexbline tests, (ii) Tensile tests, (iii) Impact tests, (iv) water absorption, and (v) moisture movement. Effect of natural weathering and accelerated weathering is also dealt with including the effect of acid rain water and action of frost.

Section five draws general conclusions, highly instructive to practical engineers.

K. SEETHARAMIAH.

**The Dynamics of Faulting and Dyke Formation with Applications to Britain.** By E. M. Anderson. Second Edition. Revised: (Oliver & Boyd, Edinburgh & London), 1951. Pp. x + 206. Price 22 sh. 6d. net.

Dr. E. M. Anderson is a rare example of a geologist who attempts to interpret geological phenomena from the physical point of view. He has interested himself for nearly fifty years in the dynamics of faulting, and sheet intrusion, and of the formation of cone-sheets, ring-dykes and caldron subsidences. The book under review was first published in 1942, and this edition went out of print in 1947. The present issue is the second revised edition, and contains some additional material.

After briefly sketching the history of research in this branch of tectonics, he discusses the dynamics of faulting under three

types: thrust faults, wrench faults, and normal faults. The dynamics of dyke formation is next considered. A rapid survey is then made of some of the more important fractures, fracture systems and dyke swarms in Britain.

The chapter dealing with faults and recent earthquakes is of great interest. Considerable work has been done in Britain, especially by Dr. Davison, in compiling a list of historical earthquakes, and this has been used by Dr. Anderson for making a comparison of the seismological and tectonic data. The close connection between faults and earthquakes is brought out by the fact that out of the 820 earthquakes which originated in Scotland, about 700 were connected with three main lines of fracture—the Great Glen Fault, the Highland Boundary Fault and the Ochil Fault. The relationship is, however, not so clear in England and Wales, though several shocks can be connected with known or inferred faults. A brief reference is made to "earth-shakes" which occur in mining districts and which possess the characteristics of shallow earthquakes.

The author finally deals with crustal dynamic problems such as uniformity of stress, vertical pressure in crust, superposition of stresses, wedging effect of sheet intrusion, strength of crustal materials, alteration of stress due to faulting, and the thermal effects of earthquakes.

The book is well printed on good paper, and is illustrated by 39 text-figures. The value of the book is enhanced by the bibliography given at the end of each chapter, and by the index.

Workers in the field of tectonics from all over the world will find this book highly stimulating and instructive.

C. S. PICHAMUTHU.

**Chemical and Electro-Plated Finishes.** By H. Silman. Second Edition. Revised. (Chapman & Hall Ltd., London), 1952. Pp. xiv + 479. Price 50 sh.

The book in its second edition goes a long way in fulfilling the need for a comprehensive treatise on the protective treatment of metals by chemical and electroplating methods.

The subject-matter is divided into fourteen chapters: Chapter I deals briefly with corrosion and the characteristic properties under corroding conditions of the important metals used in industry. The next 3 chapters are devoted to the preparation of the metal prior to finishing: descaling and pickling, polishing, degreasing and cleaning. The subject has been dealt with exhaustively, as it should be; the

types of equipment employed in industrial practice have been well described as also the essential theory. Chapter V covers the various methods for the colour finishing of metals.

The modern plant and equipment for electroplating, including automatic plant, has been described in detail in the next chapter. Chapters VII to XII deal with the electrodeposition of the important metals and alloys. A good attempt has been made to include as much of useful and up-to-date information as possible. The next Chapter is devoted to the finishing of aluminium, magnesium and their alloys: anodising, immersion treatment and electroplating. The information given is useful from the practical view-point. The last chapter gives a brief account of the different methods for the testing of finishes. Each chapter contains a list of references, although not exhaustive, and the book is profusely illustrated with diagrams, photographs, figures and tables.

The author has throughout kept in view the modern trends and industrial applications of finishing. The book will no doubt be useful to the student as well as the industrial finisher and plater. It is well written and can be regarded as a valuable contribution to the metal finishing field.

T. L. R.

**A Coloured Atlas of some Vertebrates from Ceylon, Vol. I, Fishes.** By P. E. P. Deraniyagala. Ceylon National Museums Publication, (Government Press), 1952. Pp. i-xi + 149. Plates I-XXXIV. Text Figs. 1-60.

This lovely publication is principally an album of coloured plates of the more common fishes of Ceylon. All the strictly freshwater fishes of the island as well as representatives of a few marine families are illustrated along with brief accounts of the more common genera and species. Taxonomic keys for identification and notes on distinctive features of the species are given. The work should appeal to every category of reader from the specialist to the layman. The Ceylon reader will also be pleased to get information on the places where he may look for the various forms mentioned and illustrated. It is natural that a work of this type cannot be exhaustive, but there is sufficient material in the text for the serious investigator dealing with Indo-Pacific fishes which is a field of study offering scope for much further exploration. There are many

well-known marine fishes of the Indo-Ceylon coasts which the reader will miss. This volume will be widely welcomed owing to the paucity of popular and at the same time scientifically accurate accounts of fishes inhabiting tropical waters.

The thirty-four colour plates (as well as the 60 text-figures), all done by the author, provide the most attractive feature of the book; the illustrations have been well reproduced. The Ceylon National Museums is to be congratulated for the publication of the present volume which is the first of a series on Vertebrates of Ceylon, and the first volume on fishes by the Director now published would set a high and worthy standard. The publication of the succeeding volumes will be awaited with interest.

N. K. P.

#### Books Received

*Transmitting Valves (The Use of Pentodes, Tetrodes and Triodes in Transmitter Circuits).* Electronic Valves, Book VII. By J. P. Heyboer & P. Zijlstra. (Philips Technical Library), 1951. Pp. xii + 284. Price not given.

*Application of the Electronic Valve in Radio Receivers and Amplifiers, vol. II (Electronic Valves, Book V).* By B. G. Dammer, J. Haantjes, J. Otte and H. Van Suchtelen. (M/s. Philips Technical Library), 1951. Pp. xviii + 431. Price not given.

*Merck Index of Chemicals and Drugs*, 6th Edition. (M/s. Merck & Co.), 1952. Pp. xiv + 1,162. Price \$ 7.50.

*Adhesives for Wood*, Vol. III. By R. A. G. Knight, (M/s. Chapman & Hall), 1952. Pp. xi + 242. Price 25 sh.

*The Terpenes*, Vol. III. (Second Edition). By Sir John Simonsen and D. H. R. Barton, (Cambridge University Press), 1952. Pp. xi + 579. Price 50 sh.

*Rasayana Sastra* (Madhyamika), *Marathi* (Second Edition). By M. B. Pande. (Vignana Prakasana, Nagpur-2), 1952. Pp. 303. Price Rs. 3.

*Science German Course.* By C. W. Paget Moffatt. (Oxford University Press), 1952. Pp. vii + 325. Price Rs. 7-12-0.

*Trigonometry, Plane and Spherical.* By Lloyd L. Smail. (McGraw Hill Book Co.), 1952. Pp. xii + 406. Price \$ 3.75.

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## SCIENCE NOTES AND NEWS

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### S. A. Hill Memorial Prize

The S. A. Hill Memorial Prize for the most outstanding research work done in the Allahabad University during 1950-51 has been awarded to Sri. S. N. Tewari for his work on "Hydrous Oxide of Chromium and Aluminium".

### Electrified Glass

A process which keeps the windscreens of aircraft free from ice and snow has been developed at the NPL, England. It consists in coating glass with a thin transparent film which will conduct electricity. The film can be heated by passing a current of electricity through it. Visibility through the glass is reduced by a negligible extent, while enough current can be passed through it to keep it from steaming over in cold weather.

### Research Information Service

A large number of recent patent applications by German manufacturers dealing with the manufacture and processing of textile auxiliaries are now available in English translation in the form of *Bulletins* by Research Information Service, the well-known publishers and translators of scientific papers and patent literature. The *Bulletins* may be had free of charge by writing to Research Information Service, 53 Nassau Street, New York 38, N.Y.

### Award of Research Degree

On the recommendation of a Board of Examiners consisting of Dr. S. S. Guha Sircar, Prof. M. C. Nath, and Dr. D. Chakravarti, the degree of Ph.D. of the Utkal University was conferred on Sri. Mahendra Kumar Rout, Cuttack, for his thesis "Preparation and Bactericidal Properties of Some Organic Mercury Compounds".

### Synthesis of Morphine

Details of the research work leading to the synthesis of morphine were reported recently by Marshall Gates and Gilg Tschudi of the University of Rochester, U.S.A.

Morphine is the principal alkaloid of opium and was first isolated in 1905. The complex structure of the drug was finally defined accurately in 1925. But up until now, all attempts to synthesise it had been unsuccessful. The process starts with Schaeffer's acid, a dye derived from coal tar, and twenty seven steps are taken to convert it into morphine. Syn-

thesis of codeine is an intermediate step in the process.

### Helminthological Society of India

The following Office-bearers of the Society were elected for the year 1952:

*President*:—Dr. G. S. Thapar, *Vice-Presidents*:—Dr. M. B. Lal and Dr. B. S. Chauhan, *Secretary*:—Dr. Kr. Suresh Singh (Department of Zoology Lucknow University), *Treasurer*:—Dr. J. Dayal, *Foreign Secretary*:—Dr. S. L. Hora, *Other Members*:—Dr. L. N. Johri, Dr. Anantharaman and Shri K. N. Gupta.

Dr. W. W. Cort, of Johns Hopkins University, Baltimore, U.S.A., was elected Honorary Fellow of the Society.

### Associateship Examination: Institution of Chemists (India)

The Second Examination for admission to the Associateship will be held in November 1952. The last date for receiving applications from the intending candidates is 31st July 1952. The examination in Group A (Analytical Chemistry) is divided into the following nine Sections, and the candidate will be examined in any three of them according to his choice. (1) Analysis of Minerals, Silicates, Ores and Alloys; (2) Analysis of Drugs and Pharmaceuticals; (3) Analysis of Foods; (4) Analysis of Water and Sewage; (5) Biochemical Analysis; (6) Analysis of Oils, Fats and Soaps; (7) Fuel and Gas Analysis; (8) Analysis of Soils and Fertilisers; and (9) Analysis Connected with Forensic Chemistry.

Further enquiries may be made to the Honorary Secretaries, The Institution of Chemists (India), Chemical Department, Medical College, Calcutta-12.

### Free Supply of World Fisheries Abstract

Any fisheries technologist who has had difficulties in obtaining FAO's *World Fisheries Abstracts* in the past, may hereafter acquire his subscription free in exchange for technical information. The procedure is to write to the F.A.O. Vialle delle Terme di Caracalla, Rome, Italy, expressing interest and willingness to contribute to FAO information on special subjects which may be asked for from time to time, for incorporation in the work of the FAO, its document and publications. This exchange arrangement will not, however, affect normal subscription.



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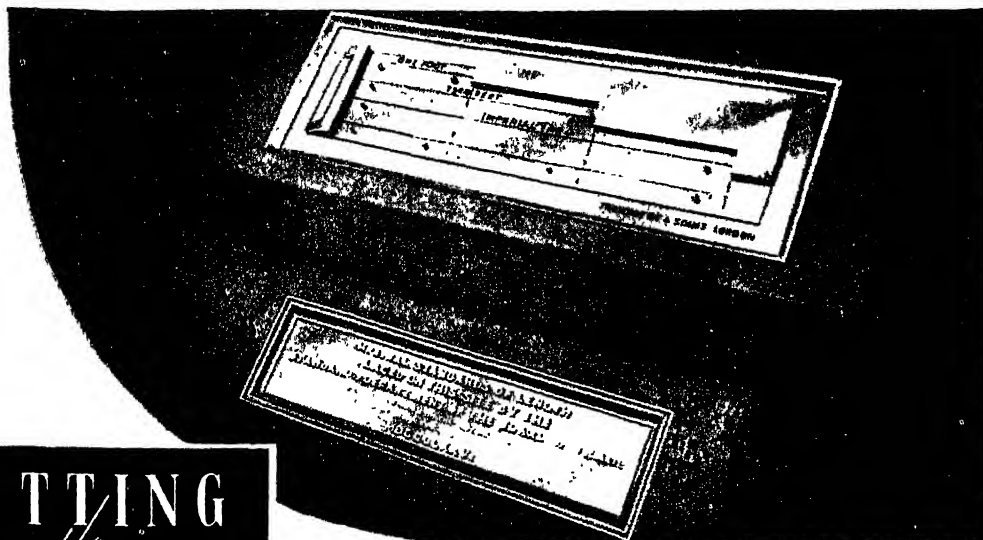
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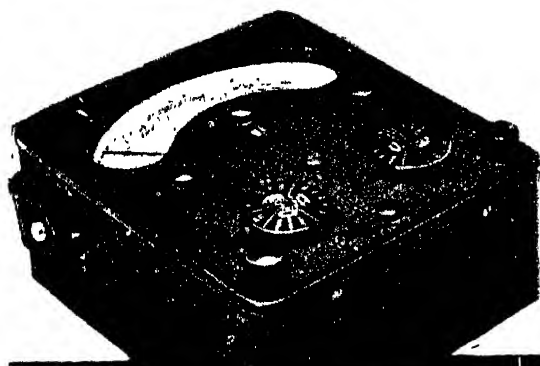
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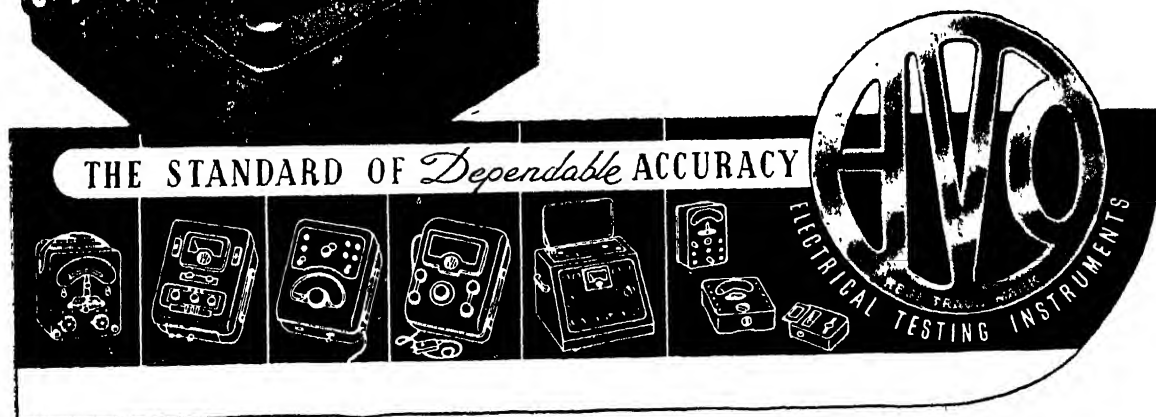
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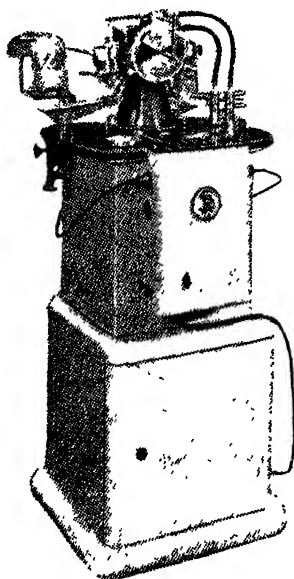
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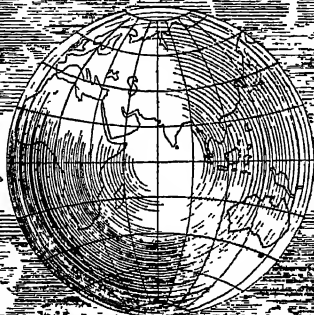
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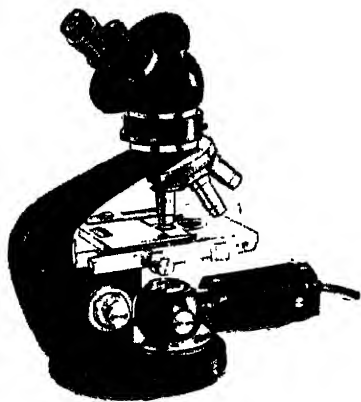
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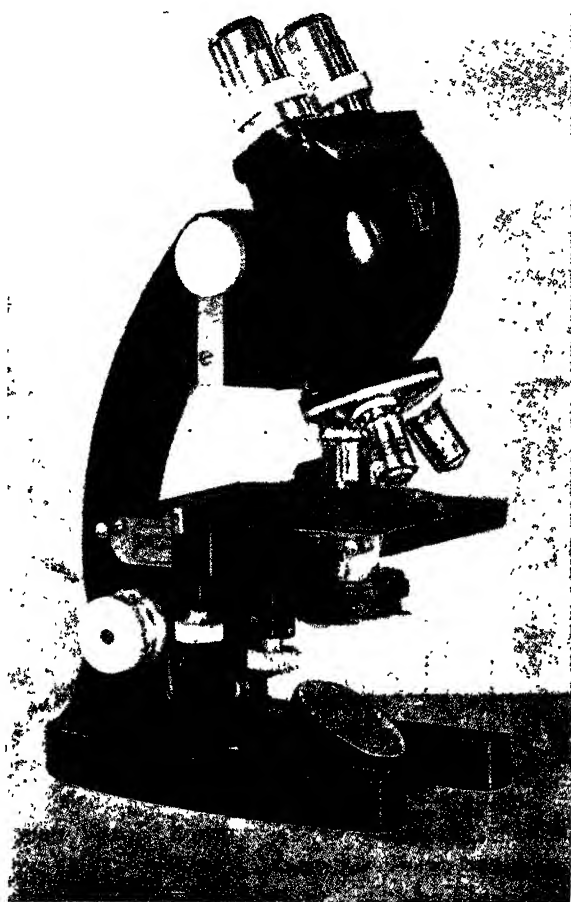
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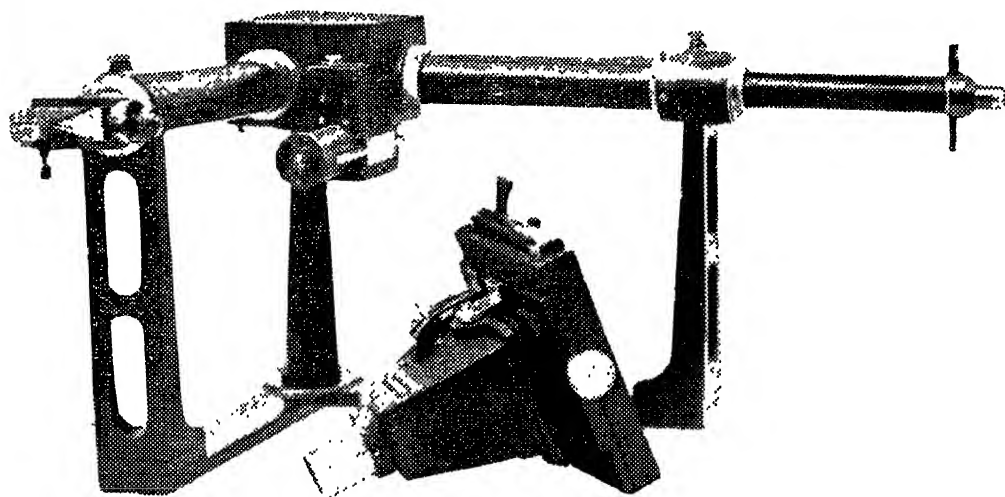
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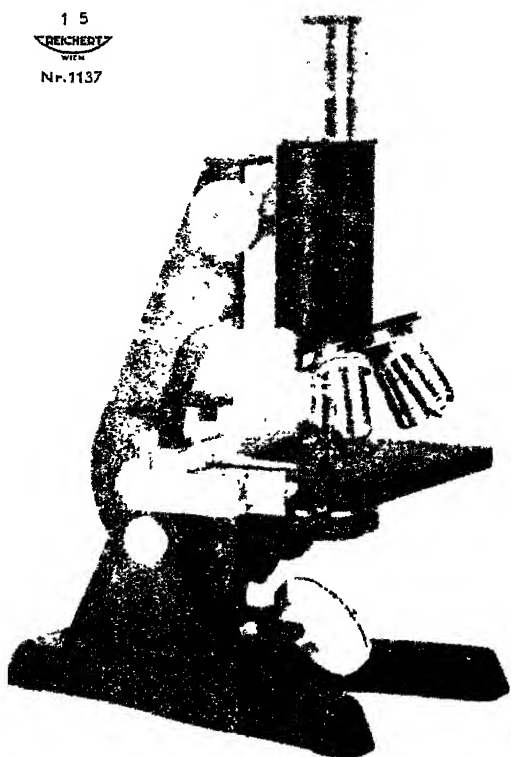
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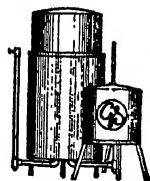
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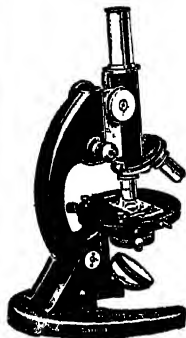


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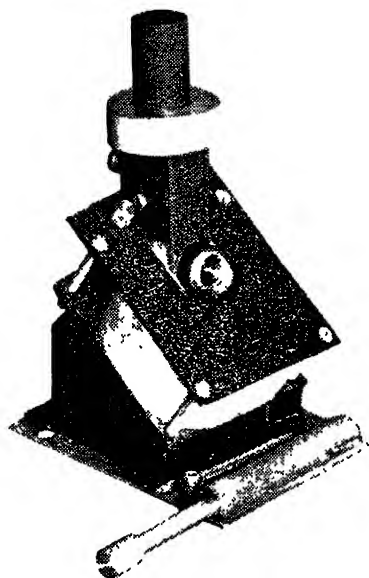
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# Current Science



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## FUEL FROM FORESTS

THE importance of forest fuel is apt to be out of focus in an industrial age where coal, oil and electricity occupy the foreground as sources of industrial power. It is worth while, therefore, to point out that while coal and oil are in the nature of fixed deposits drawn upon by man thereby inexorably diminishing the finite available stocks, fuel from the forest is in the nature of a current account which could continually be replenished; and, there is no reason why this account should not continue to run indefinitely, so long as man operates on it with prudence.

Wood was probably man's first fuel and fuel was probably man's first use of wood. Even to-day when wood has hundreds of other uses, it remains a fact that more wood is used as fuel than for all other purposes combined. Statistics relating to the annual consumption of wood in the world as a whole under various heads make interesting reading. Leloup, in a paper presented in 1949 to a Conference on the Conservation of Natural Resources, sponsored by the United Nations Organisation, made the following estimates:

Annual wood consumption in the world is 1,453 million cubic metres. This consumption is made up as follows:—

Fuel wood	825 million	57 per cent.
		cubic metres of the total
Sawn Timber	360	25
Pulp	119	8
Industrial wood	149	10

While these figures relate to the world as a whole, the consumption of wood in the individual countries varies, naturally, enormously; but, it is fallacious to assume that industrially advanced countries do not make much use of wood as fuel. For example, in the United States where wood industries are highly advanced and where alternative sources of fuel are plentiful, fuel is even to-day the largest single use of wood. The American Forest Products Industries Organisation estimates the principal uses to which the annual American wood harvest goes as follows: fuel 42 per cent., lumber 34 per cent., pulpwood 13 per cent. and all other uses 11 per cent.

There is also another angle from which we can get a perspective and appreciation of

forest fuel. If we consider the energy resources of the world as a whole, excluding from this survey atomic energy, by far the greater part of these are in the form of coal, peat, petroleum, oil shale, natural gas, wood, vegetable and animal wastes, non-tidal water power, tidal power, wind power, terrestrial heat energy, solar energy, food and man power. Long as this list is, it is far from complete. We may confine ourselves for the present to man's use of solar energy which till our own day has been the traditional and by far the largest single source from which man has drawn.

The forms in which solar energy are available to man are best and simply expressed in terms of a basic unit being the energy equivalent of one million tons of coal. Employing this unit, Parker made the following estimates. The capital resources of energy—mainly in the form of fossil fuels such as coal and petroleum—are of the order of six million million tons of coal. The energy income, mainly in the form of wood, water-power and food, are equivalent to about 5,000 million tons of coal a year. Parker estimates the world's annual consumption of fuel and energy at about 3,000 million tons of coal.

As already mentioned, the world's annual consumption of wood fuel is estimated by United Nations experts at 825 million cubic metres; equating, approximately  $1\frac{1}{2}$  cubic metres of wood to be one ton and taking five tons of wood to be equivalent to a ton of coal, this would mean that wood fuel contributes no less than the equivalent of 110 million tons of coal a year. Wood fuel is therefore significant even now in the fuel economy of the world.

Reference may be made here to another rather widely prevalent notion that since forest crops take time to mature, forest growth is a slow medium for the bottling up of solar energy. The facts are otherwise. It is true that as far as timber is concerned, a forest crop normally takes decades to be ready for harvest in contrast to an agricultural crop which often is an annual. But, if one puts into the balance sheet the entire organic matter produced by a forest crop during its normal life time, not excluding the litter produced year after year, and the root system below the ground, then, the figures make surprising reading. Ebermayr in Germany was amongst the pioneers to study this aspect of forest economy. He found that a normally stocked coniferous forest crop produces on an average about 4,000 kg. of dry organic substance per year per

acre. This figure is substantially more than the organic matter produced in two typical agricultural crops, viz., 2,000 kg. for hay and 1,500 kg. for beetroot per year per acre. Looking upon vegetation as merely a means of fixing carbon from the atmosphere into burnable carbon compounds, we thus see that a forest crop can be about twice as good as an agricultural crop. The 4,000 kg. of organic matter annually produced by an acre of forest would yield about 2,000 kg. of fixed carbon which on complete combustion should give 16 million kilocalories. This, then, is about the average amount of solar energy trapped by a forest crop per year per acre.

It is thus seen that contrary to appearances, forest crops are efficient converters of solar energy into usable fuel in the form of organic carbon and that wood is an important fuel even in highly industrialised countries.

The hydrolysis of wood into sugar has ushered in yet another technique by which wood is processed to cater to man's energy needs. And, according to present technique and practices in America, roughly 100 tons of wood yields about 35 tons of a 50 per cent. sugar solution. The product could be used as food for man, cattle feedstuffs or for fermentation to alcohol. The significance of the process lies in that the raw material, namely, wood residues are the waste product from wood working industries. Wood sugar thus opens up entirely new vistas of energy sources for use by man.

It is against this background of the importance of wood fuel that the inadequacy of our forest resources in India has to be assessed. International expert opinion prescribes 25 per cent. of the total area of the country as the safe minimum to be dedicated to forests. India has less than 20 per cent. The United States, Germany, France, the Scandinavian countries all have larger proportions; even Japan where the pressure on land of a much more industrialised people is acute has more than half her area under forest. In our country, the inadequacy of the total forest area is further aggravated by its uneven distribution adversely affecting our national economy in diverse ways. One of the most glaring examples and most pernicious in its effects is the misuse of wood as fuel instead of its rightful application as manure. This sets up a vicious circle which ultimately makes both food and fuel scarcer and dearer.

In South India, the absence of coal and oil has invested wood fuel with even greater importance. Wartime exploitation coupled with large increases in our urban populations have

compelled control, and sometimes even rationing, of wood fuel. The extent and urgency of the problem is best brought out with reference to figures relating to a typical urban area like Bangalore.

Bangalore with a population of about 700,000 might be reckoned to have 100,000 families. One family would need, confining strictly to domestic kitchen needs, about 2 cwts. of food fuel a month; even with this modest average, Bangalore needs 10,000 tons of wood fuel per month or 120,000 tons per year. Assuming the very high yield of 18-20 tons of fuel from an acre of forest, some 6,400 acres or 10 square miles of forest are needed to cover the annual fuel indent. And working on a short 30-year rotation, this means that 300 sq. miles of good forest are the minimum needed to ensure merely the domestic fuel indent of Bangalore alone on a none-too-liberal scale. This poses stupendous problems.

It is probable that these problems are solved not by any single cut and dry method. A many-sided approach is called for. Legislative measures might be considered for regulating the use of wood as industrial fuel. It is obviously not wise economy to feed the factory boiler while the domestic hearth remains unlit. Legislation might also be useful to discourage excessive fellings and to encourage afforestation.

Our domestic ovens may be redesigned to lessen dissipation of heat and also to burn waste material. Electric heating may be popularised. Coke may find acceptance in some of the areas. It may even be necessary in the over-all national interests, to gasify coal and lay down domestic supplies of heating gas in the larger cities. Last, but not least, and simultaneously with these measures, trees and more trees should be grown, the costs of their protection being drastically cut down with the active co-operation of enlightened public opinion.

India is said to abound in paradoxes. It is certainly odd that wood fuel—which is merely conserved solar energy—should be in short supply in this tropical country where the sun shines longer and brighter than in other less favoured climes. Some of the fastest growing forest species too are to be found in our country. We are therefore exceptionally well endowed by a kindly nature for the manufacture—if that term be permissible—of wood. The forest is the factory, and fuel one of the manufactured products. And, unless we grow more forests along with more food, the grim prospect of our having to import not only food but cooked food as well, is not as remote as some would have us believe.

M. N. RAMASWAMY.

#### LADY TATA MEMORIAL TRUST SCHOLARSHIPS AND GRANTS FOR 1952-53

THE Trustees of the Lady Tata Memorial Trust announce the following awards of Scholarships and Grants for the year 1952-53.

The International Awards of varying amounts (totalling £5,000) for research in diseases of the blood with special reference to Leucæmias are made to Doctors A. R. Gopal Ayengar (India), Pascou Atanasiu (France), J. E. G. Dausset (France), Astrid Fagraeus and Bo. Thorell (jointly) (Sweden), N. Harboe (Denmark), Charles Oberling (France), C. C. Ungley (England), J. Kieler (Denmark), C. Merskey

(South Africa), R. Rask-Neilsen (Denmark) and R. Robineaux (France).

Indian Scholarships of Rs. 250 per month each for one year for scientific investigations having a bearing on the alleviation of human suffering from disease are awarded to Messrs. Madhav Vinayak Patvardhan (Coonor), Anant Vithal Sunthankar (Bombay), P. Venkateswarlu (Trivandrum), Rajaram Vasudeo Bhagwat (Bombay) and Doctors Jandhyala Sri Ram (Bangalore) and Purindra Nath Sen Gupta (Patna).

#### 1851 EXHIBITION SCHOLARSHIP AWARD

THE Royal Commissioners for the Exhibition of 1851, London, have awarded an overseas scholarship for 1952 to Shri H. K. Jain,

Indian Agricultural Research Institute, New Delhi, for research in plant breeding at the University College of Wales, Aberystwyth.

## RUSSIAN VIEWS ON PAULING'S THEORY OF RESONANCE

THE recent report of the Commission of the Institute of Organic Chemistry of the Academy of Sciences, U.S.S.R., on the present state of the theory of chemical structure contains many passages which vehemently attack the theory of resonance as propounded by Pauling. A critical reading of the whole report\* shows that though the title of the report is 'The Present State of the Chemical Structural Theory' the real aim is to denounce the theory of resonance. This denunciation starts with a quotation from Lenin—"Reactionary aspirations are being bred by the progress of science itself. The wide advance of natural sciences, the approach of uniform and simple elements of matter, the laws of motion which can be mathematically treated produce the oblivion of matter by mathematicians. 'Matter disappears', equations alone remain. At this new stage of development, and in a quasi-novel fashion there reoccurs the old Kantian idea that the mind orders the laws of nature." The theory of resonance is quoted as an example of "physical" idealism and mathematical fetishism.

It is suggested that in this theory a concept of quantum mechanical resonance structures is created on the basis of a formal interpretation of one of the possible methods for the approximate calculation of molecules and further this concept is used for the explanation of facts of chemistry as though it existed as a physical phenomenon. To quote from the English translation of the report—"The wave function  $\psi$  (which describes the state of the molecule) is approximately represented by a sum, to each member of which is ascribed the meaning of a definite chemical structure. It is then asserted that the 'resonance' of these 'structures' causes the real state of the molecule. Thus 'resonance structures' and the resonance between them are the chief 'discovery' of the theory of resonance."

The following, in brief, are the points of criticism offered against the concept of the theory of resonance:

(i) This concept is connected with a particular mode of interpreting the separate wave functions, the linear combination of which serves as the approximate mathematical description of the state of the molecule. If other

approximate methods of calculation are used,† the concept of resonance does not arise at all.

(ii) Resonance structures are fictitious and the problem of isolating them is 'senseless'. Concepts of 'resonance structures' and their 'resonance' has neither experimental nor theoretical justification.

(iii) The notion of 'resonance energy' with its source in the 'quantum-mechanical resonance structures' is not valid. According to Pauling the deviation between the experimentally determined energy of formation and the corresponding energy calculated according to the additive scheme is identical with resonance energy. The deviations from additivity can obviously never be caused by the non-existent resonance structures.

(iv) The theory of resonance rests upon a methodologically false foundation. "Pauling and his followers substitute for the real molecule a collection of resonance structures, and for the actual factors which determine the properties of molecules a non-existent resonance between these structures."

(v) Followers of Pauling, particularly Wheland, hold idealistic Machian views. "They consider resonance to be a 'theoretical concept' and subsequently they establish the 'influence' of this resonance (i.e., of this concept) upon the properties of the molecules." This is an anti-scientific logic.

(vi) It is an idealistic concept and consistent use of this theory would lead to pseudo-scientific conclusions and produce the semblance of a 'scientific' explanation where essentially no explanation is given.

In the report it is mentioned—"It is regrettable that the faulty concepts of bourgeois science have also exerted an influence on Soviet scientists." Work of many Soviet scientists who have used this concept of the theory of resonance has been adversely criticised. In particular there is a very trenchant criticism of the book 'The Chemical Bond and the Structure of Molecules' by Ya. K. Syrkin and M. E. Dyatkina. The 'entire spirit of the book is permeated by ideas belonging to the theory of resonance'. It appears that this book was once prescribed as a text-book in chemical colleges. "In this way, it aided in spreading the perverse idealistic theory of re-

\* An admirable English translation of the report has appeared in *Jour. Chem. Edu.*, 1952, 29, 2-13.

† Reference is made to Sokolov, N. D., *Uspekhi Khim.*, 1949, 18, 697.



sonance among workers in the field of chemistry."

The report also contains a directive for the Soviet scientists. "Soviet chemists and physicists should collaborate intensively to develop a theory of the mutual influence of the atoms in the molecule. Here special attention should be paid to uprooting the remnants of the influence of the resonance theory."

The aspect of the theory of resonance to which the Russians so violently object is essentially the following:†

"From the foregoing discussion we see that resonance is a man-made concept in a more fundamental sense than most other physical theories. It does not correspond to any intrinsic property of the molecule itself,

but instead it is only a mathematical device, deliberately invented by the physicist or chemist for his own convenience."

In view of this, one cannot object to the great stress laid on the physical non-existence of resonance structures, but what is surprising is the vehemence with which the criticism is voiced and the manner in which it is linked with political ideology. It appears that after the Lysenko controversy the Soviet scientists are now busy in "uprooting" the theory of resonance.

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O. N. PERTI.

† Quotation from Wheland's *Theory of Resonance and Its Application to Organic Chemistry*.

### SCIENCE AND ENGINEERING\*

THERE have been few attempts to appraise with impartiality the liaison between science and engineering. On the one hand, the natural sciences have developed in the last quarter century a program of propaganda which, however essential in securing the support which research in science not only deserves but must have, has resulted in establishing in the popular mind the notion that engineering is merely a commercialisation of science—is, in fact, simply "applied science". Many people have assumed, therefore, that expanded research in science is all that is necessary to insure our continued technological and industrial supremacy. "The pure science of to-day," it is said, "becomes the applied science of to-morrow." On the other hand, engineers have been too busy "doing" to worry about what they regard as largely an "academic" question.

Probably the basic fallacy in this campaign of misunderstanding has been the statement, made and spread by many able scientists, that engineering is simply an outgrowth of and development from modern science, born of scientific research and still completely nourished by its parent. Important as the present liaison between science and engineering is, no more completely untruthful and dangerous statement could be made.

The case of Britain offers a striking example of the sterility of science alone as a prime factor in our industrial and economic life. From Faraday to Maxwell and Kelvin, from Darwin to Huxley and Tyndall, Britain had produced some of the greatest leaders in modern science. Yet, in the last fifty

years—years which have marked such an extraordinary era of material progress in the United States—Britain, the motherland of the Industrial Revolution, has been steadily declining in her industrial and economic position. If pre-eminence in science, as the propaganda of science so confidently proclaims, is all that is necessary to continued industrial leadership and technological progress, why has Britain fallen into what has been described as technological and industrial stagnation and decay?

It would be unrealistic indeed to ascribe this British decline solely to the high-hat attitude of British Science and the low estate to which engineering has fallen in Britain. To begin with, the British economy, based on the export of manufactured products and necessitating the import not only of basic materials but of essential food supplies, is clearly precarious and vulnerable to foreign competition. During the Victorian period when Britain almost stood alone industrially speaking, and ruled the waves, all was well. But, with the turn of the century, it became apparent that Britain no longer held an industrial export monopoly. The difficulty appears to have been that her industrial leaders did nothing about it. Adopting a self-satisfied, complacent attitude, she failed to follow up her earlier triumphs with continued developments and improvements—to realise that it is impossible to maintain a static position in a world based on technology and industry. Progress and change are not, as we have said, merely desirable—they are essential

\* Abstract of an article by F. K. Finch, *Jour. Frank. Inst. Sci.*, 1952, 253, 201.

to survival. A stable, static economy is impossible—it is but the prelude to decline and decay.

This is not perhaps the place for an analysis of all the influences which have led to industrial and economic collapse in Britain. But certainly, one of the factors which has contributed to her unprogressive attitude has been the fact that science in Britain has succeeded in establishing the idea—as science in America seems latterly bent on doing—that engineering is merely cheap, applied science, and such applications can be left to those whose interests are vocational rather than professional and whose minds are directed solely to commercial pursuits—in short, given science, applications will take care of themselves.

Engineering is regarded as a “navvy”, a laborer’s pursuit in Britain—it is not a recognized profession. Engineering education is still largely a matter of rather narrow vocational technical school instruction—it is not a recognized university activity. There also appears to be a notion that the engineer deals only with science, with the materials and the forces of nature. The fact that his task is pro-

duction and that he must work with and direct men is ignored. Here is a washing of the hands of any connection with machine skills or engineered production, with the direction of labor. Here is a complete failure to realise that design is not an end in itself but merely a means to intelligent production.

The light has now begun to dawn, however, for, more recently, Sir Ewart Smith, in a paper reprinted in *The American Scientist*, clearly stated the truth, namely: “Any real basic knowledge which is evolved is broadly and relatively quickly available to all, and it is therefore upon technological skill in application that the progress of industry and, consequently, the economic position of the nation will mainly depend”. Scientists not only do not possess this skill—there is every reason why it should not be one of their interests—but it would be a grave mistake if they should deny that the technique of application is, in itself, a subject of special knowledge, study and research. Indeed, it’s what we do with knowledge—all available knowledge—that will determine a country’s strength and progress. Science alone is not enough.

### ARTIFICIAL COSMIC RAYS

IT is reported that the giant cosmotron at the Brookhaven National Laboratories, New York, is able to accelerate protons to energies of the order of 1360 million volts, which is more than three times greater than what has been possible till now. Also it appears that the range attained recently is only half that for which the machine has been designed. At full capacity it is expected to deliver atomic projectiles with energies of the order of 2,500 million volts.

By all standards, this must be considered as quite a remarkable achievement: for, as the energies associated with cosmic rays are almost of the same order as those produced by the cosmotron, this opens up the way to their being generated artificially in the laboratory, with a view to study their properties under controlled conditions—a feat considered as rather impossible till now.

### INTERNATIONAL UNION FOR THE PROTECTION OF NATURE

MAN’S responsibility for the progressive formation, first of semi-arid regions, then of arid regions and finally of deserts being what it is, it is a pleasure to welcome the formation of an International Union for the Protection of Nature. We hope and trust that facilities will be made available to the Union in generous measure to enable it to fulfil the aims and objects set out in No. 2, Vol. 1 of its *Official*

*Bulletin*, viz., to examine critically the multifarious dangers with which nature is confronted consequent upon the constantly heavier pressure exerted by technicians upon biological cycles, to devise protective measures against wastage on the countryside, and to consider ways and means of extending the same over the widest area possible.

## LETTERS TO THE EDITOR

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### OBLIQUE INCIDENCE PULSE OBSERVATION OF THE IONOSPHERE NEAR THE MAXIMUM USABLE FREQUENCY

SOME time ago Appleton and Beynon<sup>1</sup> reported some signal intensity phenomena associated with continuous shortwave transmissions over a sender receiver distance of 1140 km., as the operating frequency approached, equalled and then exceeded the maximum usable frequency (m.u.f.) of the controlling layer of the ionosphere. Later Beynon<sup>2</sup> described both pulse and continuous wave experiments over a sender receiver distance of 715 km., but his experiments were mainly intended to discuss the Lorentz polarisation term in relation to

the ionosphere and to check the m.u.f. predictions made from the normal incidence ( $P'f$ ) curves. No oblique incidence pulse observations seem to have been reported so far, in which the fading sequence reported by Appleton and Beynon<sup>1</sup> was studied. The present note describes results of observations made at Waltair on pulse transmissions from the All-India Radio Transmitter at Delhi, on a frequency of 21.7 Mc./s., over a sender-receiver distance of about 1,500 km. The pulses were radiated from 14 20 hrs. to 16 10 hrs. I.S.T., from the 20th February to 1st March 1952 and these were received on a communications receiver modified for pulse reception, the receiver output being displayed on an Oscillograph. Ionospheric data

show that during this period the pulses were received after a single reflection at the  $F_2$  layer of the ionosphere and that the operating frequency was near the m.u.f. of the  $F_2$  layer. Normally, therefore, only a single pulse was received and the amplitudes of the pulse were noted at intervals of 5 seconds.

A typical temporal variation of the pulse amplitude when the operating frequency was near the m.u.f. of the  $F_2$  layer and the  $F_2$  ionisation is decreasing is shown in Fig. 1 below. At the beginning of the transmissions

extraordinary ray too penetrated the  $F_2$  layer 20 seconds after the disappearance of the ordinary ray, i.e.,  $16^h 8^m 20^s$ .

The reported sequence is similar to the one reported by Appleton and Beynon<sup>1</sup> which was explained by these authors on the assumption of a parabolic region of the reflecting layer. The sudden increase in the signal amplitude which such an assumption predicts, when the operating frequency was equal to the m.u.f. was clearly observed as has been observed by Beynon<sup>2</sup> although Appleton and Beynon

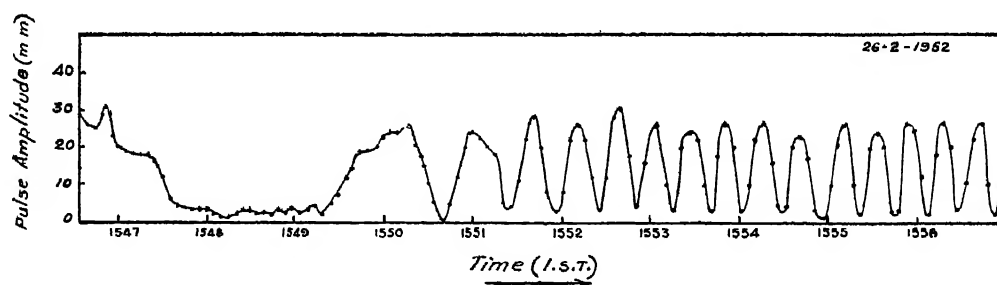


FIG. 1. Fading of pulse amplitude near m.u.f. Pulses from Delhi received at Waltair. Freq. 21.7 Mc/s Distance about 1,500 km. 26th February 1952.

the amplitude of the pulse varied slowly and in a random manner. During this time only the ordinary ray was received and the extraordinary ray suffered heavy absorption. After some time conditions were suitable for the reception of the extraordinary ray and the first signs of a periodic fading appeared at  $15^h 46^m 48^s$  due to the interference between the two unresolved magnetoionic components. The frequency of the fading is seen from the figure to be 0.75 cycle per minute at the beginning and this increased to 6 cs./mt. at  $15^h 56^m$  in about 10 minutes and remained almost constant thereafter. At  $15^h 58^m 10^s$  another pulse of amplitude 2 mm. was received with a time delay of 0.5 millisecond corresponding to an optical path difference of 150 km. This is the so-called high angle or Pedersen ray. The separation between these pulses gradually decreased and finally they coalesced 10 minutes after appearance of the Pedersen ray, i.e., at  $16^h 8^m$  giving a single pulse whose amplitude rose suddenly from 10 mm. to 31 mm. Just at this time the operating frequency corresponded to the ordinary ray m.u.f. of the  $F_2$  layer. Soon the ordinary ray penetrated the  $F_2$  layer and the pulse amplitude decreased to 5 mm. in about 5 seconds and remained almost steady in amplitude but for slight fading. At this time the extraordinary ray was still returned. The

could not observe this due to the overloading of their receiver.

A detailed account of the observations will be published shortly. The author wishes to express his thanks to the Director-General, All-India Radio, for co-operation in these studies and to Prof. K. R. Rao, for giving the necessary facilities.

Wireless Research Lab., Y. V. SOMAYAJULU,  
Physics Dept., Andhra University,  
Waltair,  
March 6, 1952.

1. Appleton, E. V. and Beynon, W. J. G., *Pro. Phys. Soc.*, 1947, 59, 58.
2. Beynon, W. J. G., *Wireless Engineer*, 1948, 25, 322.

## REFRACTIVITY OF NAPHTHALENE VAPOUR

A RAYLEIGH refractometer was constructed for measuring the refractive indices of vapours of crystalline solids, as it was felt that the data would be valuable in any discussion on the molecular theory of double refraction in crystals. The details of our investigation on naphthalene vapour are given here. The usual method of determining the refractivity of a vapour at a pressure actually measured by a manometer was not however adopted. On

the other hand, advantage was taken of the availability of the saturated vapour pressure data at different temperatures in the International Critical Tables.

Sufficient amount of solid naphthalene was introduced into the refractometer tube which was evacuated and heated so as to saturate the space with the vapour. The side tube containing the solid was kept at a temperature  $2^{\circ}$  to  $4^{\circ}$  lower than the main tube through which light passed, in order to avoid condensation of naphthalene on the glass windows. Thus the pressure of the vapour inside was obviously the saturated vapour pressure at the temperature of the side tube.

The refractivity of the vapour was calculated by the formula

$$\mu - 1 = \frac{n \lambda}{l},$$

where  $l$  is the length of the tube,  $n$  is the number of fringes shifting and  $\lambda$  is the wave-length of light; and the refractivity was reduced to N.T.P. by means of the equation

$$\mu_0 - 1 = (\mu - 1) v,$$

where  $v$  is the ratio of the volume occupied by one gram-molecule of the vapour under experimental conditions, to the volume at N.T.P. ' $v$ ' was calculated directly from the equation of state for the vapour. It was found that Van der Waal's equation and Berthelot's equation gave the same value for  $v$ ,\* while the ideal gas equation  $p v = T/273$ , gave a value which was only very slightly higher (less than 0.1%) than this. The results are given in Table I. Mean refractivity of the vapour is thus

$$(3341 \pm 64) \times 10^{-6}.$$

TABLE I

No.	Temp. of the side tube $^{\circ}\text{C}.$	Vapour pressure mm.	$(\mu - 1) \cdot 10^6$	$(\mu_0 - 1) \cdot 10^6$
1	66.1	2.88	10.71	3533
2	72.3	4.47	15.88	3466
3	75.7	5.75	19.10	3236
4	84.4	9.5	29.66	3129

The significance of the above result may be briefly discussed here. Ramanadham<sup>1</sup> calculated the principal polarisabilities of naphthalene molecule, applying the theory of anisotropy of polarisation field in liquids, and compared them with those deduced from the known refractive indices of the crystal. He subsequently revised the latter calculation utilising the data furnished by Sundararajan.<sup>2</sup> The revised

values are however unpublished, and they are given in Table II.

TABLE II

Principal polarisability	From anisotropic polarisation field theory ( $\times 10^{24}$ )	From refractive indices of the crystal ( $\times 10^{24}$ )
$b_1$	25.85	28.53
$b_2$	22.25	20.68
$b_3$	9.00	9.40

The values of the refractivity of the vapour, calculated from the data in columns 2 and 3 according to the equation

$$\frac{\mu - 1}{2\pi\nu} = \frac{b_1 + b_2 + b_3}{3},$$

are respectively  $3217 \times 10^{-6}$  and  $3302 \times 10^{-6}$ . The present experimental value  $3341 \times 10^{-6}$  is therefore in satisfactory agreement with that calculated from the refractive indices of the crystal.

The author is thankful to Sri. M. Ramanadham for his interest in this work.

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Madras,  
March 12, 1952.

\* The constants for these equations for naphthalene were taken from *Landolt Bornstein Tables*, Vol. 1, p. 259, 1923.

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## GEOMORPHOLOGICAL EVOLUTION OF DELHI AREA

THIS preliminary note deals with certain aspects of geomorphological features noted in Delhi State. North-South running belts of pre-Cambrian Alwar quartzites forming the Delhi ridge (800'-840') is flanked with two types of sediments—the eastern 'Khadar' on lower grounds (700') and the western 'Bhangar' on slightly higher grounds (700'-800'). The symmetrically folded quartzites were subjected to peneplanation by Tertiary times<sup>1</sup> and uplifted to form the present day flat topped ridges. North-south running valleys were initiated along lines of structural weakness, i.e., along anticlinal axis, so that we now get a parallel system of flattopped synclinal ridges intervened by anticlinal valleys, which latter are covered by Bhangar alluvium.

Intensive geological traverses and inspection of innumerable stone quarries show that there is only one rock-type in the area—the grey quartzites. Occurrences of tourmaline quartz veins are statistically insignificant. A number of soil profiles from Khadar and Bhangar areas were examined. Mineralogical analysis data of two typical soil profiles together with analysis of quartzites are given in Table I. These results show that the quartzites have not, in any way, given rise to these alluviums, which are quite rich in elements and minerals not found in the quartzites. The quartzites are characterised by blocky weathering, whereas the texture of Bhangar is uniformly silty sand<sup>2</sup> and that of Khadar varies between clay and coarse sand.<sup>3</sup> Presence of abundant  $\text{CaCO}_3$  concretions in the soils when contrasted with the absence of any lime-bearing mineral in the rocks is also confirmatory. Exposures of contact of alluvium and rock are frequently met in gully sections and are found to be very sharp, the rocks remaining quite unaltered.

The uniform silty texture throughout the profile, presence of considerable rounded grains below the critical limit of water rounding (0.03 mm.) and field characteristics suggest that the Bhangar alluvium is of aeolian origin.<sup>4</sup> The texture is slightly coarse (median diameter (0.087 mm.) compared to that of typical loess (median diameter 0.017 to 0.037 mm.),<sup>5</sup> but the degree of sorting as indicated by quartile deviation measure (0.67  $\phi$ ), calculated from a mechanical analysis carried through Wentworth grades, is comparable with that of loess (0.34  $\phi$  to 1.49  $\phi$ ).<sup>5</sup> Relative coarseness of Bhangar

may be explained as due to the nearness of its probable source—the Rajputana Desert, whereas loess is generally deposited at a greater distance from its source—the Pleistocene glacial deposits.

The Khadar alluvium on the other hand, is a result of the sedimentation of the Jumna. Wide variations of texture from horizon to horizon, presence of horizons rich in certain detrital minerals like garnet and mica and practical absence of grain rounding stamp the sediment as of riverine origin.

Sedimentation was not continuous in the Bhangar area, there being several periods of rest which are marked by horizons of conglom-

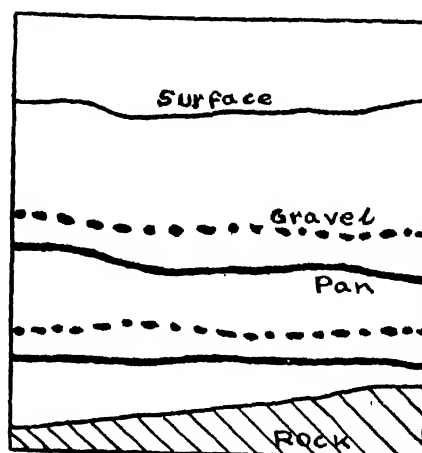


FIG. 1. Schematic cross-section of a gully face. Vertical height about 30 feet.

TABLE I  
Showing the mineralogical analysis data of two soil profiles and the quartzite of Delhi

Locality	Escorts (Khadar)			Todapur (Bhangar)			Quartzite
Depth in inches	0-2"	9"-18"	48"-63"	0-9"	35"-40"	80"-90"	
Heavy % in fine sand	2.3	2.2	0.8	2.4	2.8	3.0	0.5
Ratio of quartz to feldspar in fine sand	n.d.	n.d.	n.d.	6	5	4	49
Mineral frequency in heavy fraction of fine sand							
Pyroxene	7	7	8	29	26	32	nil
Hornblende	35	23	15	25	27	23	tr
Epidote-zoisite	9	3	6	21	20	24	nil
Biotite	11	17	23	2	1	nil	3
Muscovite	12	20	19				33
Chlorite	1	2	7				1
Iron ores	9	4	tr	10	10	5	37
Iron oxides	5	5	5	4	1	5	tr
Garnet	5	10	9	8	11	6	tr
Tourmaline	2	2	1	1	1	2	22
Zircon	2	4	1	1	1	1	tr
Others	..	..	2	1	2	2	tr

merate, about 8" thick, persistently occurring in at least two levels. These periods of rest were of sufficient duration to allow pedogenic factors to operate, segregating  $\text{CaCO}_3$  in both the levels of alluvium to develop a hard pan layer (Fig. 1). That these pans are not due to the present pedogenic activity is evidenced by the fact that overlying these "fossil" soils occur, at one exposure, about six feet of undisturbed lacustrine varve sediments at the rate of about 30 annual layers per foot, without any sign of vertical translocation of materials to indicate soil formation in the varves.

The alternations of the conglomerate, aeolian and lacustrine sediments and the pan indicate a fluctuating history of aggradation and degradation punctuated with periods of rest. These fluctuations may be due to fluctuations in climate and or crustal movements and are in continuation of the process which have given rise to the peneplaned Tertiary "quartzite" surface and the terraced nature of the Bhangar with respect to the graded flood plain of the Jumna Khadar. The Bhangar is now subjected to degradation as indicated by the young system of ravines in the area.

Studies relating to this problem of past climate and crustal fluctuations are being continued.

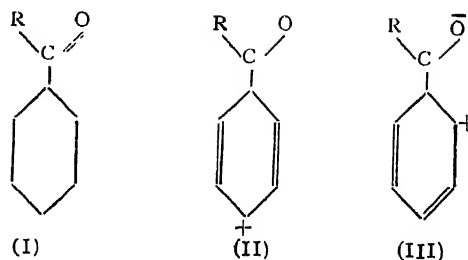
Chemistry Division,  
Ind. Agri. Res. Inst.,  
New Delhi-12,  
February 19, 1952.

NARAYAN SEN.

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### ABSORPTION SPECTRUM OF ACETOPHENONE

THE ultraviolet absorption spectrum of acetophenone was studied in ether solution by Kato and Someno,<sup>1</sup> in alcoholic solution by Grammaticakis<sup>2</sup> and in liquid and solid states by Deb.<sup>3</sup> In this work the absorption spectrum of the vapour has been investigated and an interpretation has been suggested for various band heads. About 130 red degraded bands have been measured in the region  $\nu$  35235 to 39038. According to the resonance theory the aromatic carbonyl compounds are best represented as the combination of the classical structures I and quinonoid structures II and III.<sup>4</sup>



R = H or any alkyl group

The molecule can be classified as one belonging to the point group  $C_{2v}$ . The observed band system can be attributed to the allowed transition  $A' - A'$ . The spectrum resembles that of pseudocumene<sup>5</sup> (1 : 2 : 4-trimethyl benzene) which belongs to the same point group.

The (0, 0) band is located at  $\nu$  36394. Towards the red side of the (0, 0) band a large number of bands could be measured and among these the Raman frequencies<sup>6</sup> 164, 615, 850, 950, 998, 1024, 1073 and 1157 could be identified. The band corresponding to Raman frequency 998 is very intense. The bands at distances 17, 28 and 59  $\text{cm}^{-1}$  from (0, 0) band to the red side are interpreted as difference frequencies of  $1 \rightarrow 1$  type transitions. Towards the violet side of the (0, 0) band the spectrum extends to  $\lambda$  2560. From the positions of the band heads the following excited state frequencies are suggested:

$\nu'$  523, 745, 753, 938, 951, 1531.

A detailed discussion of the analysis will be published elsewhere.

Andhra University,  
Waltair,  
April 17, 1952.

G. VISWANATH.

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### AGAVE VERA CRUZ—A SOURCE OF POLYFRUCTOSANS

AMONG some of the little known, indigenous sources of foods examined by us, one is the plant, *Agave vera cruz* (N.O. *Amaryllidaceae*; Hindi: *Rakaspatta*; Tamil: *Marakathalai*). Portions of the plant, it is known, are eaten by the poorer classes, especially under conditions of famine.

The succulent, surface underwood of the plant was the material used for investigation. Preliminary examination revealed that the carbohydrates, which form major portion of the soluble solids in the material, are a mixture of polyfructosans.

Inversion of the press juice (initial rotation ca.  $-20^\circ$ ) resulted in fructose<sup>1</sup> and a rotation ( $-74.6^\circ$ ) not parallel to fructose. There was no glucose in the hydrolysate, as determined by the method of Klein and Acree.<sup>1</sup> Nor did treatment with alcohol, acetone, neutral lead acetate or alumina cream help to obtain a homogeneous polyfructosan fraction.

TABLE I

Effect of treatment on the rotation of the press juice

Treatment	$[\alpha]_D^{25}$	
	Before inversion†	After inversion
Acetone: precipitate obtained dissolved in water	$-20.7^\circ$	$-75.8^\circ$
Lead acetate: filtrate dealed	$-19.3^\circ$	$-76.8^\circ$
Alumina cream: filtrate	$-20.8^\circ$	$-74.7^\circ$

† From observed rotation and solids in solution.

On extraction of the dried and powdered material with methyl alcohol, two fractions resulted, one soluble, and the other insoluble, in that solvent. Working with a 2-lb. lot, soluble fraction amounted to 68% and the insoluble fraction to 32% (including fibre).

An aqueous solution of the fraction soluble in methyl alcohol was treated with 90% ethyl alcohol till complete precipitation: the precipitate was freed from alcohol and dissolved in water and the aqueous solution clarified with alumina cream and filtered. The optical rotation  $[\alpha]_D^{25}$  was  $-29.31^\circ$ , and increased to  $-77.85^\circ$  on inversion. Aqueous extract of the fraction insoluble in methyl alcohol was filtered from fibre and the filtrate (colloidal and opalescent) treated with neutral lead-acetate and dealed with  $\text{Na}_2\text{CO}_3$ . The optical rotation  $[\alpha]_D^{25}$  was  $-16.8^\circ$ , and increased to  $-86.8^\circ$  on inversion. Thus the methyl alcohol-soluble fraction, on hydrolysis, gave rise mainly to fructose, but the rotation of the hydrolysate was, again, lower than that due to fructose. On the other hand, the carbohydrates in the methyl alcohol, insoluble fraction, on hydrolysis, gave rise to fructose, with a rotation of  $-86.8^\circ$  which allowing for concentration and temperature, is

in close agreement with the value for fructose ( $-91^\circ$ ).

In a modified experiment to obtain the methyl alcohol-soluble portion, 10 g. agave powder (dried at  $100^\circ$ ) was refluxed successively with methyl alcohol (100 ml.) for 30 minutes in each case. The supernatant solution was decanted off before adding a fresh charge of methyl alcohol. The optical rotation of the successive fractions are shown in Table II. It was observed that with each charge of methyl alcohol, the solutes decreased, while the initial rotation progressively increased. This indicated that the portion grossly designated "methyl-alcohol soluble," is again a mixture of carbohydrates.

TABLE II

Rotation of the different fractions obtained with methyl alcohol

Extract	% Solutes	$[\alpha]_D^{25}$	
		Before inversion	After inversion
I & II	3.06	$-23.44^\circ$	$-74.49^\circ$
III & IV	1.39	$-25.67^\circ$	$-76.65^\circ$
V	0.51	$-26.72^\circ$	$-77.59^\circ$
VI & VII	0.76	$-30.18^\circ$	$-85.4^\circ$

Characteristics of the successive fractions obtained with methyl alcohol bear a close analogy to the carbohydrates present in Jerusalem artichoke. These carbohydrates, according to Thaysen, *et al.*,<sup>2</sup> consist of fractions with initial rotations  $-17.91^\circ$ ,  $-30.71^\circ$ ,  $-35.4^\circ$  and after hydrolysis,  $-59.39^\circ$ ,  $-74.29^\circ$ ,  $-85.6^\circ$ .

As polyfructosans have now been shown to be the main constituent of the edible portion of *Agave vera cruz*, there arises a doubt regarding the value of this material as food. In this context, the finding of Cremer and Lang<sup>3</sup> that Jerusalem artichoke alone is poorly utilised in the system is significant.

The authors' thanks are due to Dr. V. Subrahmanyam, for suggesting the problem and for helpful criticisms.

Central Food Technological Res. Institute,  
Mysore,  
March 15, 1952.

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N. SUBRAMANIAN.

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# A NEW RECORD FOR THE FOSSIL WOOD *GLUTOXYLON* FROM THE SOUTHERN PART OF WEST BENGAL

RECENTLY one of us<sup>1</sup> has reported on the form genus *Glutoxylon*. Since then we have received a fossil specimen of secondary wood from Mr. R. N. Chaudhuri, who collected it from the bed of the river Silabati, 7 miles from Garbeta Railway Station in the district of Midnapur, West Bengal. According to him, the specimen is 8 ft. long and 2½ ft. to 3 ft. in diameter and has been found embedded at a depth of 30 ft. from the surface. A piece 5 inches long and 2½ inches in diameter has been sent to us. The Geological Survey of India gives the locality as "most probably Tertiary in age, possibly Late Tertiary".

The fossil wood shows a combination of two important anatomical characters, namely, the narrow bands of irregularly spaced apotracheal parenchyma cells some of which end abruptly (Fig. 1) and the horizontal gum ducts in the

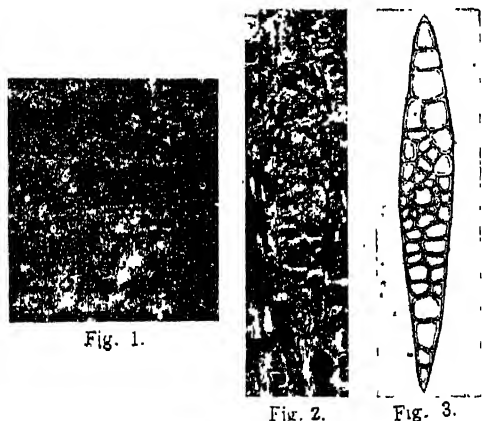


Fig. 1.

Fig. 2.

Fig. 3.

FIG. 1. Cross-section showing distribution of parenchyma cells and vessels.

FIGS. 2. & 3. Tangential section showing simple rays and a fusiform ray with gum duct.

fusiform rays (Figs. 2, 3). These anatomical features have led us to classify it under the genus *Glutoxylon*. On further comparison with *Glutoxylon burmense* (Holden) Chowdhury, it shows no difference in minute anatomical structure. The specimen from Garbeta is, therefore, named *Glutoxylon burmense* (Holden) Chowdhury.

According to previous records,<sup>2</sup> the western limit of the genus is the extreme east of Ranigunj Coalfield, from which the present locality, Garbeta, is about 60 miles towards south. The new find is of considerable interest in view of

the absence of *Gluta* in Bengal and of its present distribution in India.

The specimen bears Forest Research Institute fossil No. 74 and has been deposited in the Dehra Dun collection.

Our acknowledgements are due to the Director, Geological Survey of India, for information on the age of the locality.

Forest Research Institute, K. A. CHOWDHURY.  
Dehra Dun,  
K. N. TANDAN.  
April 10, 1952.

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## BIOGENESIS OF ASCORBIC ACID IN SPROUTING LEGUMES

ON the basis of observations that vitamin C formation is augmented in legume embryos grown in nutrient media containing glucose and mannose,<sup>1</sup> and that germination in the dark also results in stimulation of ascorbic acid formation along with increase in reducing sugars through enhanced amylolysis,<sup>2</sup> sugars have been suggested as active precursors of vitamin C. This has been demonstrated more directly with the rat, especially when chloretone-fed,<sup>3,4,5</sup> adequate thiamine nutrition being a prerequisite in this case.<sup>6</sup> Chloretone, however, is not utilised directly for vitamin C synthesis<sup>7</sup> and presumably exerts its effect upon the enzyme systems which control the oxidation of glucose.<sup>8</sup> Studies on the partial degradation of the biosynthetic ascorbic acid after administration of labelled glucose have provided evidence that the total transfer of C<sup>14</sup> from glucose to ascorbic acid was approximately equivalent to total conversion of dietary carbohydrate to ascorbic acid by weight.<sup>7</sup> The observations would suggest that the carbon chain of glucose may not be broken before being converted to ascorbic acid. However, the possibility of recombination of the fragments without a major dilution effect could not be ruled out and would seem the probable route from other observations<sup>9</sup> on the stimulatory effects of glyceraldehyde and pyruvate in *in vitro* studies with liver slices of chloretonised rats. This is also inferable from the facts that chloretone administration to rats results in simultaneous increased urinary excretion of ascorbic and glucuronic acids<sup>3,4,5</sup> and that glucuronic acid is formed from C<sub>3</sub> substances.<sup>10</sup> Recent work from this laboratory would lend

support to the view that conversion of glucose to ascorbic acid takes place through mediation of the glycolytic route rather than through a direct oxidative pathway. Among the various observations made, using sprouted mung seeds or embryos therefrom, may be mentioned the following:

- (1) Vitamins of the B group, particularly thiamine, riboflavin and nicotinic acid, catalyse the oxidative breakdown steps that result in the formation of ascorbic acid from glucose.
- (2) The acids involved in the intermediary metabolism of glucose, particularly fumaric and succinic acids, stimulate biogenesis of vitamin C.
- (3) There is a close parallelism between the elaboration of ascorbic acid and of nicotinic acid under a variety of experimental conditions. The latter vitamin is partly found as pyridino-protein enzymes although on account of the high DPNase activity in seedling extracts they are not estimable in this form except when using nicotinamide during extraction.<sup>11</sup>
- (4) Use of selective inhibitors of certain enzymes concerned in glucose breakdown, such as azide, iodoacetate and fluoride and in phosphorylation such as 2:4 dinitrophenol and atabrine, adversely affect ascorbic acid formation. The inhibitors similarly influence nicotinic acid, phosphatase and particularly pyrophosphatase activities.
- (5) Malonate, a competitive inhibitor of succinic dehydrogenase depresses ascorbic acid synthesis.
- (6) In proper concentrations, certain mitotoxic agents such as chloretone, urethane and coumarin favour vitamin C synthesis. This results presumably from a metabolic shunting of glucose intermediates away from the normal pathway and towards steps leading to ascorbic acid synthesis.

Details are being published elsewhere. One of us (S. P. B.) is grateful to the Lady Tata Memorial Trust for the award of a Research Fellowship.

Dept. of Chem. Technology, SMITA P. BHARANI.  
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March 29, 1952. A. SREENIVASAN.

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#### IDENTIFICATION OF ISO-OLEIC ACIDS PRESENT IN HYDROGENATED FATS BY PAPER CHROMATOGRAPHY

IN an investigation on the nutritive value of hydrogenated vegetable oils, we have been interested in the determination of the content and nature of iso-oleic acids present in such fats. Apart from the analytical procedures (such as that of Cocks, Christian and Harding<sup>1</sup>) which estimate the total content of iso-oleic acids, the only method available for the identification of individual isomers is that due to Hilditch and Vidyarthi<sup>2</sup> which involves the oxidation of a mixture of methyl esters of the acids and the subsequent identification of the resulting mono and dibasic acids. Though the oxidation itself is easily carried out, the isolation of the dibasic acids in an adequate state of purity is achieved only after a series of steps such as the conversion of the acids to their dimethyl esters, their fractionation and fractional crystallization of the free acids after hydrolysis of the esters. The physical and chemical characteristics of the acids thus isolated leave no doubt about their identity but the purity of the final samples, however, is seldom satisfactory. Also the quantitative interpretation of the results is rendered difficult since the pure samples of the acids isolated form only a very small percentage of the crude fraction. Begemann, *et al.*<sup>3</sup> have effected a separation of the dibasic acids by adsorbing the mixture on a silica gel column followed by elution with a mixture of ethanol, methanol and water.

We have successfully employed the method of Reid and Lederer<sup>4</sup> for the separation of dibasic acids formed on oxidation of mono-ethenoid fatty acids. These authors have found that malonic and succinic acids do not move up on the paper; but the lengthening of the carbon chain, presumably because of the greater partition coefficient of the acids between buta-

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nol and water, results in a significant movement of the acids on the paper and hence the dibasic acids from pimelic acid upwards can be easily separated by this method. The acids show themselves as yellow spots on a purple background. The  $R_f$  values of a few of the acids are as given below:

Acid	$R_f$ value	
Pimelic	..	0.046
Suberic	..	0.085
Azelaic	..	0.14
Sebacic	..	0.20
Undecanedioic	..	0.31
Dodecanedioic	..	0.40

} Calculated from chromatograms obtained from vanaspati

With the availability of this method for the separation and identification of dibasic acids, the identification of the various iso-oleic acids present in hydrogenated fat is rendered facile. The mixture of ethyl esters of the component fatty acids from hydrogenated fat is oxidized in acetone solution as described by Hilditch and Vidyarthi<sup>2</sup> and the dibasic acids separated from the monobasic acids by distillation in vacuum. The mixture of dibasic acids is applied as a spot to the paper in the form of its solution in dilute aqueous ammonia along with the spots of the ammonium salts of the pure acids and the chromatogram developed in the usual manner. The tracings from two such chromatograms obtained from a sample of "vanaspati" and from an iso-oleic acid fraction prepared from it by a method worked out in these Laboratories (to be published) are shown in Fig. 1. Spots in the diagram are due to

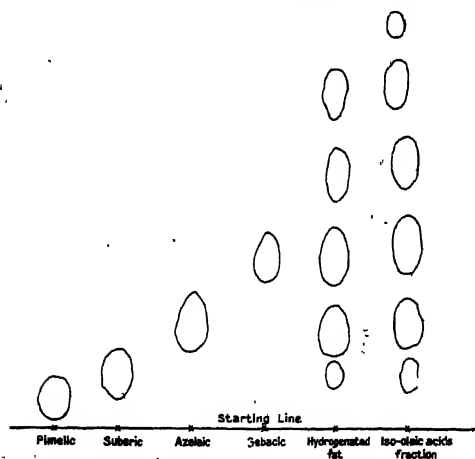


FIG. 1. Chromatographic separation of dibasic acids,

suberic, azelaic, sebacic, undecanedicarboxylic and dodecanedicarboxylic acids indicating the presence of  $\Delta$  8-, 9-, 10-, 11-, and 12-octadecenoic acids in the hydrogenated fat sample.

Quantitative aspects of this method are being studied and will be reported later.\*

Nutrition Res. Laboratories, S. S. PHATAK.  
Indian Council of Medical Research, A. P. MAHADEVAN.  
Coonoor, V. N. PATWARDHAN.  
May 1, 1952.

\* The above work is supported by a grant from the Council of Scientific and Industrial Research.

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### SCHIZOTETRANYCHUS ANDROPOGONI HIRST, A PEST OF SUGARCANE

THE incidence of mites on sugarcane varieties in Bihar has been recorded by Khanna and Ramanathan, who have identified the mite as *Paratetranychus indicus* Hirst. The symptoms of attack described by them are identical with those noticed for the first time at Coimbatore on certain sugarcane varieties. The mites noticed at Coimbatore have been identified (by Baker of United States Department of Agriculture) as *Schizotetranychus andropogoni* Hirst. This is the first record of this pest in South India on sugarcane. Cherian has recorded it on the grass *Dicanthium annulatum*. Other alternate hosts noticed by the author at Coimbatore are *Erianthus fulvus* and *Miscanthus nepalensis*.

The attack is in the form of whitish oval patches on the underside of the leaves and very rarely on the upper surface of the leaf as well. The webs are thin and semi-transparent in the beginning and become whitish with age. The mite feeds on the leaf tissue by scraping the epidermis and sucking the juice. A badly affected leaf turns yellow and eventually dries up. Old leaves seem to have a preference over younger ones presumably because they are horizontally placed and hence afford protection to the under-surface. The patches often contain shrivelled eggs, reddish brown castings and cast off skins. The eggs are tiny, roundish structures, pale green in colour and look like beads. They are laid singly in linear rows inside the web at the rate of

6-15 or more per web. The mites are whitish or pale green and are seen moving about very actively. When a web is disturbed they are seen moving about in all directions but usually they return to the same web especially when the eggs are there. Sometimes they weave a new web at a different place. Two individuals take part in the weaving of a web each moving in the opposite direction in an oval form. Usually 10-15 individuals in various stages of development are seen inside a web.

Varietal differences are noticed as regards susceptibility or resistance to this pest. The presence of bristles and stomatal grooves in the lower epidermis have been noticed by Khanna and Ramanathan to be factors responsible for susceptibility of varieties. Attempts are being made to artificially infest a number of commercially important varieties, as also those used in breeding with a view to studying their resistance and work out a correlation with anatomical structure. Some of the varieties have taken up the infection and further work is in progress.

Thanks are due to Shri Nand Lal Dutt, for guidance. The author is indebted to Dr. E. W. Baker of United States Department of Agriculture, for kindly identifying the mite.

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October 31, 1951.

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#### CONTROL OF MOLLUSCAN FAUNA THROUGH THE CULTURE OF *PANGASius PANGASius* (HAMILTON)

MOLLUSCS are known to act as intermediate hosts for several helminth diseases of cattle and man, and in certain areas of India their large populations may be a source of great danger to livestock. Without affecting the biota of a natural or artificial piece of water, it is difficult to control them by the use of chemicals. Some measure of biological control would, therefore, seem highly desirable to keep down the population of molluscs.

Certain species of fish are known to feed on molluscs and a widely distributed, but not

very common species *Labeo calbasu* (Hamilton), popularly known as *Kalbasu* in Bengal, has been stated to include molluscs regularly in its menu. The fish that almost exclusively feeds on molluscs, where such food is available in abundance, is however, the Cat-fish, *Pangasius pangasius* (Hamilton). Mr. P. I. Chacko of the Directorate of Fisheries, Madras, found that in the months of June and July, this species predominates in the catches of the Mettur Reservoir and that the Gastropod molluscs of the genera *Melanoides* and *Indoplanorbis* "form the largest single item of food consumed by the species". In one of the specimens, Mr. Chacko found 400 shells, mostly *Melanoides* (*Tarebia*) *lineatus* (Gray). This specimen had been caught from the portion of the reservoir near the dam, late in the month of April. The shore of the reservoir in this portion is covered with rocks and stones where *Melanoides* are found in abundance. In the 3rd week of February this year, I found *Pangasius* fairly abundant in the catches of the Mettur Reservoir, but the specimens mostly came from the far end of the reservoir where the bottom and shore are mostly covered with mud. We found the species mostly feeding on *Vivipara* but were informed by local fishermen that bivalves are also eaten by them in large numbers during certain seasons. In a specimen, 28.2 inches in total length, 307 shells, mostly *Vivipara*, were found in the intestine. In another specimen, 25.2 inches in length, there were 288 shells. By weight also, the shells formed a very large proportion of the waste material. In a specimen 25.8 inches and weighing 6.75 lb., the viscera constituted 1.5 lb. In another specimen, 23.0 inches in length and 6 lb. in weight, the viscera was 1.5 lb. in weight.

Mr. A. David of the Central Inland Fisheries Research Station, Barrackpore (Calcutta), informs me that this species is cultured in some ponds of East Bengal along with species of carps. He recalls of an incidence at Khulna, when he inquired from the owner of a pond whether *Pangasius* was not destructive to carps. The owner had a few specimens of *Pangasius* caught from the pond and showed that they mostly fed on molluscs, in this case *Pila*.

It is thus established that *Pangasius* prefers to feed on molluscs of any kind, of which large quantities are ingested at a time. *Pangasius* can, therefore, be used profitably for cultural purposes where molluscs form a serious pest. It will not only control the growth of molluscs,

but will convert their bodies into a wholesome fish good and still permit their empty shells, which are expelled unharmed, to be used as grit for poultry.

A detailed account of the bionomics and possibilities of culture of *Pangasius pangasius* will appear elsewhere.

Zoological Survey of India, S. L. HORA.  
Indian Museum,  
Calcutta 13,  
April 3, 1952.

### OCCURRENCE OF *ARENICOLA* IN BOMBAY

THE author discovered well-developed specimens of *Arenicola*, one of the polychaete annelids, in a muddy flat near Bombay. The largest specimen measured 20 cm. Reference to the Zoological Survey of India, Calcutta, revealed that *Arenicola* had not previously been recorded in any part of India and that its discovery in Bombay was of considerable significance.

The first complete account of the family Arenicolidae was given by Ashworth,<sup>1</sup> and its study has since been continued by many European authors. The distribution of the family Arenicolidae, as recorded by Ashworth (1904), is restricted more to the northern hemisphere above 40° North, only two species having been recorded in a zone slightly south of latitude 40°. The discovery of *Arenicola* in Bombay (Lat. 20° N.) thus extends its geographical distribution by 20° South of the previous records. A closer examination of the specimens found in Bombay shows that the species is new to science. The number of known species has thus been raised from nine to ten. A detailed taxonomic account of the new species is being worked out at the laboratory.

Taraporevala Marine M. R. RANADE.  
Biological Station,  
Bombay 2,  
April 25, 1952.

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### REGENERATION OF FINS IN SOME AQUARIUM FISHES

THE complete regeneration of the caudal fin of a gold fish kept in an aquarium after it had been bitten off by another led us to carry out a series of experiments on regeneration of fins

in fishes. Most of the previous authors<sup>1-11</sup> had concentrated on caudal fin, especially of freshwater species. In the present series of experiments, however, observations were conducted on regeneration of not only the caudal fin but also the pectoral, soft dorsal, anal and pelvic fins. The experiments were carried out on the following species of marine fishes: *Epinephelus diacanthus* (C. V.), *Pomadasys argyreus* (C. V.), *P. maculatus* (Bl.), *Lutjanus malabaricus* (Bl. Schn.), *Arius dussumieri* (C. V.), *Therapon jarbua* (Forsk.), *Pterois russellii* (Van Hass.) and *Balistis vetula* Linn. The selected species were all fully acclimatised.

It was observed that irrespective of the fin cut and the nature of the cut made, regeneration took place within five to eight and a half weeks, the exception being the adipose fin of *Arius dussumieri* (C. V.), which, when cut in various degrees, only healed up but did not regenerate. Regeneration time varied in different cases, the more anterior the cut made the longer being the time for complete regrowth. The strong spine of the pelvic fin of *Pomadasys maculatus* (Bl.) showed an arrested growth and remained as a blunt stump. Regeneration also took place when the fin was fully amputated. In *Therapon jarbua* (Forsk.) the amputated caudal fin grew into a normal fin while the fully amputated pectoral fin of *Lutjanus malabaricus* (Bl. Schn.) developed into a dwarfed abnormal fin.

In all cases the regenerated portion remained transparent for a time and pigmentation took place only at a later stage. Even after pigmentation was complete, the regenerated part could be distinguished for a long time.

Department of Marine K. GOPINATH.  
Biology and Fisheries, A. JOSEPH.  
University of Travancore,  
Trivandrum,  
January 29, 1952.

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# ON THE FOOD AND FEEDING HABITS OF FIREFLIES

ALMOST no record is available of the feeding habits of Indian Fireflies, only a few foreign species having been studied and recorded.<sup>1-6</sup> McCann<sup>3</sup> made observations on the feeding habits by keeping the glow-worm healthy for two years on a diet of landsnails. Parsons<sup>4</sup> recorded *Lamphophorus nipalensis* feeding on slugs.

I have been able to ascertain some more interesting facts regarding the food and feeding habits in the Indian species, *Luciola gorhami*. The adults did not show any liking for plant food and even earthworms, crustaceans and other arthropods remained untouched. Lastly, slugs, landsnails and pondsnails with shell broken were given. A male was noticed on the body of a slug. The insect had made a strong grip by the mandibles and ejected out a slightly frothy dark coloured liquid which probably broke down the victim's tissue as now the whole head was immersed in the pulpy liquid and immediately after, the sucking of the tissue was observed under a binocular microscope, in a dim blue light. The blue light was observed to be the least disturbing one. When the insect moved from that place, it created a hollow space on the snail's body which measured 0.45 mm. broad and 0.2 mm. deep. Further, by sectioning and by dissections, it was revealed that the mandibles of the adults were not at all provided with any passage like that of its larva, through which the fluid might ooze out. The fluid was spit through the mouth and later sucked by closely aggregating the mouthparts. The suction was probably affected by the collapsible nature of the large hepatic cæcæ present at the end of crop. The specimen was immediately dissected and the dark liquid seen outside was also found in these cæcæ. The females were hardly seen to take any type of food.

The larvæ on the other hand are voracious feeders of small arthropods, crustaceans, worms, etc. A supply of different types of food showed that the molluscs do not form the main diet of the larvæ as has been reported by foreign workers on exotic species. It is interesting to note that I could study the complete life-cycle of the insect *Luciola gorhami* Ritz., by keeping the larvæ solely on a diet of earthworms. They also ate up the dead fireflies leaving behind the hard chitinous parts. The larvæ bore through the soil in search of their prey and remained under soil if their food resources get exhausted on the surface.

I am much indebted to Prof. S. Keshava, for technical guidance and to Dr. R. D. Saxena, for confirming my observations.

Zoology Department, P. N. SAXENA.  
Science College, Patna University,  
Patna,

December 14, 1951

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## BLOOM CHARACTER IN CASTOR OIL PLANT (*RICINUS COMMUNIS* LINN.)

VARIETIES of castor oil plant are distinguished by the presence or absence of bloom on the vegetative parts of the plant. Whereas only two types of bloom were described by Harland,<sup>1</sup> three have been defined by Patwardhan.<sup>2</sup> They are:—A *Single bloom*: Presence of bloom on stem, petiole and peduncle. B. *Double bloom*: Presence of bloom on stem, petiole, peduncle and under-surface of leaf. C. *Treble bloom*: Presence of bloom on the aforesaid parts and also upper surface of leaf.

During the investigation of this character in 1947, at the Research Farm, Kanpur, the existence of other sub-types of bloom were discovered both in Class A and B. They were isolated and sown next year in different beds in order to determine their purity. All are breeding pure for noted characters. Harland has also mentioned that "in Class A one or more sub-types may be recognised, but so far no attention has been given to these."

The different classes of bloom noticed by us are given below:

1. Bloom on the peduncle and capsules only.
2. Very light bloom on the stem, petiole and inflorescence.
3. Single bloom.
4. Single bloom plus bloom on the prominent veins of under-surface of leaf.
5. Partial double bloom, i.e., bloom on the stem, petiole, peduncle and some portions of under-surface of leaf—the margins are left uncovered.
6. Double bloom.
7. Partial treble bloom, i.e., double bloom plus bloom on some portions of the upper surface of leaf—the margins remain uncovered.
8. Treble bloom.

The identification of the 4th, 5th and 7th classes of bloom can be easily made in young leaves of plants whereas in old leaves the bloom tends to become less and less heavy till it is completely obliterated. The genetical behaviour of some of these characters will be given later.

The author is grateful to Prof. K. N. Kaul, for help and guidance and to Dr. T. R. Mehta, for facilities provided at the Research Farm, Kanpur.

Land Reclamation Board, ANUBHAV NARAIN.  
Bhopal,  
March 18, 1952.

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# REVERSED POLARITY IN THE EMBRYO-SAC OF *NAPOLEONA* *IMPERIALIS* PAL. B.

AMONG Myrtifloræ, cases of reversed polarity in the embryo-sac were previously recorded in *Fuchsia marinka*,<sup>1</sup> *Woodfordia floribunda*,<sup>2</sup> *Lagerstroemia indica*,<sup>3</sup> *Oenothera gigas*<sup>4</sup> and *O. Lamarckiana*.<sup>4</sup>

During the course of embryological studies in Lecythidaceæ, the writer encountered a case of reversed polarity in the embryo-sac of *Napoleona imperialis*. In this species, an 8-nucleate embryo-sac is developed in an ovule, according to the normal type. Occasionally, however, ovules with two megaspores, two megaspore tetrads and two embryo-sacs also occur. The ovule sketched in Fig. 1 contains

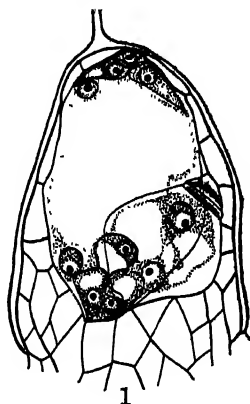


FIG. 1. Reversed polarity in one of the two embryo-sacs.  $\times 430$ .

two embryo-sacs, one of them at the 2-nucleate stage and the other at the 8-nucleate stage. In

the latter, the antipodals (three in number) and a polar nucleus are situated at the micropylar end while the egg apparatus and the other polar nucleus are at the chalazal end. The two synergids can be distinguished by their pear-shaped form and the basally-situated vacuoles and the egg by its characteristic flask-shaped form and prominent vacuole in its upper part.

Andhra University, J. VENKATESWARLU.  
Waltair, India,  
March 21, 1952.

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# WHITE NONSPORING MUTANTS OF *PENICILLIUM NOTATUM* *CHRYSO-* *GENUM* INDUCED BY RADIOACTIVITY

STAKMAN, DALY, GATTANI AND WAHL<sup>4</sup> have shown that addition of uranium nitrate to potato dextrose agar at the rate of 0.5-1.0 g./l. stimulated mutation in the cultivated mushroom, *Agaricus campestris*, and both mutation and an unusual type of dissociation in the ordinary corn smut fungus, *Ustilago zeæ*. In *Agaricus campestris* the spawn of some mutant lines produced mushrooms of white colour instead of brown. They suggested that addition of uranium nitrate or other similar salts to nutrient media may be a simple and useful means of inducing desirable mutations in at least some micro-organisms. The agar containing uranium nitrate is mildly radio-active, as determined by Dr. Alexander Hollaender of the Oak Ridge National Laboratory, U.S.A.<sup>4</sup> The investigation reported in this paper was undertaken to obtain some mutants of *Penicillium notatum chrysogenum* in an attempt to determine the biological significance and usefulness of the changes induced by radio-activity in that organism.

Monosporous cultures of strain 18 of *P. notatum chrysogenum* isolated from Indian soils by Gattani and Kaul<sup>1</sup> were used for these studies. For inducing mutations, the strain was at first grown on potato dextrose agar media containing 0.5 and 1.0 g. uranium nitrate/l. When growth commenced on these media, the actively growing mycelium was transferred to media containing 0.5, 1.0, 1.5 and 2.0 g. uranium nitrate/l. By the immediate transfer of the actively growing mycelium from media containing low concentrations of uranium nitrate to those containing high concentrations of ura-

mium nitrate the frequency of mutation as evinced by the production of morphologically distinct sectors, was enhanced greatly on media containing 1.0, 1.5 and 2.0 g. uranium nitrate/l. The fungus when transferred directly from potato dextrose agar to media containing 0.5 and 1.0 g. uranium nitrate/l. showed small sized colony with comparatively few sectors and on medium containing 1.5 g. uranium nitrate/l. growth of the fungus was inhibited completely.

More than fifty primary mutants were obtained from this strain and they were cultured on potato dextrose agar for one and a half months by making weekly transfers. During this period about twenty variants reverted to their parental type and were discarded. Of the remaining, 16 showed green sporing areas of different shades and 14 were mycelial in character and white in colour. From the white variants four designated as 18B, 18C, 18D and 18F were selected for detailed study.

The four white variants were purified by making single hyphal tip isolations and grown on Czapek agar along with parent strain 18. In strain 18 the colonies were velvety, plane with pistachio green to American green colour, with a biverticillate penicillus showing two divergent columns of spores. In 18B the colonies were white and spongy, in 18C white and flocculent, in 18D white, flocculent in the central portion and smooth else where and in 18F they were white and smooth. All white lines were mycelial, without any penicillus or spores.

Penicillin-producing ability of these lines was tested by the plug method as described by Raper, Alexander, and Coghill<sup>1</sup>, and by growing them in surface culture in liquid Czapek Dox medium. Assays were conducted according to the method suggested by Schmidt and Moyer.<sup>3</sup> It was seen that the four white mutants were poor producers of penicillin than their parent.

White variants 18C and 18F during culture invariably gave green distinct sectors. Single spore isolations from these sectors produced green colonies with all the characters of *P. notatum chrysogenum* group. Two of such secondary green mutants 18C-1 and 18F-1 showed more penicillin production than their immediate white parents. However, the other two white variants did not produce any green variants.

It appears from these investigations that radioactive emissions from uranium nitrate promote the production of white, mycelial nonsporing mutants in strain 18 of *P. notatum*

*chrysogenum*. This asexual reproductive sterility may be partial as in 18C and 18F or complete as in 18B and 18D. When it is partial green mutants with all the characters of *Penicillium notatum chrysogenum* group are again produced from such lines. White, mycelial, nonsporing mutants produce less penicillin than their parent.

Dept. of Agriculture,  
Rajasthan, Bharatpur,  
March 25, 1952.

M. L. GATTANI.

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#### NOTE ON THE CYTOLOGY OF *ATROPA ACUMINATA* ROYLE EX LINDLEY

FROM the medicinal standpoint, *Atropa belladonna* Linn., the source of Atropin, is one of the most important plants in the family Solanaceæ. The other source of the same drug is *Atropa acuminata* Royle ex Lindley, called the Indian Belladonna. The leaves and other aerial parts as also roots of both plants may be used as source material. The vegetative parts of allied plants may be used as adulterants for these two which supply the true drug. As such, the anatomical studies of all these plants have been an important subject of research. Comparative anatomical studies of the two Belladonna plants have been worked out by Feinstein and Slama,<sup>3</sup> George,<sup>4</sup> Melville<sup>5</sup> and Unger.<sup>6</sup> The cytology of *A. belladonna* has been tackled by Vilmorin and Simonet.<sup>7</sup> In this context a cytological study of the Indian plant was considered desirable.

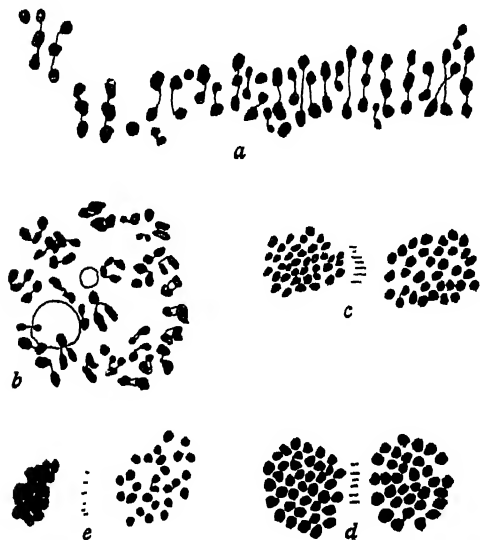
Developing flower buds for meiotic studies were obtained from the nursery at the Lloyd Botanical Gardens, Darjeeling. Herbarium sheets were made from these same plants, from which later pollen were analysed. Seeds brought down to Calcutta would not germinate and so somatic plates could not be obtained. To all appearances the seeds remained viable for 1 to 2 months but radicles would not emerge.

It is here reported for the first time that the chromosome number of this species, similar to other members of this genus,<sup>2,7</sup> is  $2n = 72$ . Although only meiotic counts have been made, the diploid number has been given here as



the true haploid number  $n=36$  was not observed in any p.m.c. This is a hexaploid of the rather high base number for the genus,  $x=12$ .<sup>1</sup>

Chromosomes are quite large in size, they fall within a wide range and form varied configurations with interesting consequences. Trivalents are most common, varying from 9 in the complement to as few as three (Figs. a & b). The number for the species was deter-



Meiotic plates of *Atropa acuminata* Royle ex Lindley.  $2n=72$ . Figs. (a)  $\times 2880$ . Anaphase I (spaced cut) =  $5_1, 20_{II}, 11_{III}, 9_{III}, 11_{III}, 11_{III} = 72$ . (b)  $\times 1150$  Diakinesis I = 2 nucleoli and  $2, 27_{II}, 11_{III}, 4_{III}, 11_{III}, 11_{III}, 11_{III} = 72$ . (c)  $\times 1440$ . Metaphase II = 38-34 separation. (d)  $\times 1625$  Metaphase II = 39-33 separation. (e) Metaphase II.  $\times 1440 = 27-?$  separation. No 36-36 separation was seen.

mined from side views of first anaphases and polar views of second metaphases. In a hexaploid, multivalents of a high order are expected but chains and rings of no more than quadrivalents have been observed and that too only in some diakinesis figures (b). Univalents present may be from 5 to none in number. Occasionally a pair or two lag at the equator. Trivalents may separate as univalents or as bivalents and univalents. Such bivalents may persist in dyads (c, d & e), and tetrads. Homologous chromosomes do not tend to have interconnections at diakinesis or group together secondarily at metaphase.

It is expected that the separation of the above chromosomes should be somewhat irregular. A regular 36-36 separation was never observed in a total of about a hundred plates. In the figures, a 38-34 and a 39-33 separation are shown (c & d). Some dyads contain

as low a quota as 27 but the corresponding dyad may not possess the rest of the complement (45), because of laggards.

#### Pollen Analysis

	Percentage of total	Average size	Size Range	Commonest size
Pollen with 3 germ pores	78.2	9.9 $\mu$	8.2 $\mu$ -11 $\mu$	9.9 $\mu$
Pollen with 2 germ pores	20.7	6.7 $\mu$	4.9 $\mu$ -8.2 $\mu$	6.6 $\mu$
Aborted grains	0	..	..	..

Pollen are abundant in perfectly formed anthers. There are no aborted pollen and no giant pollen. All grains were seen to stain with aceto carmine. In spite of meiotic irregularities therefore the chromosome balance is not affected and pollen are completely formed. This is possible because of the high ploidy of the species. The plants are annual herbs propagated from seeds. It is difficult to picture how the plant depending as it does on pollination can maintain its chromosome balance in the generations, when the number in dyads is so irregular. Data on the percentage of seed setting and the germination of these seeds should throw light on the matter.

The lowest base number for Solanaceae is  $x=8$ , therefore the haploid number for *Atropa* is a derived one. Both *A. belladonna* and *A. acuminata* being hexaploids their ancestry is bound to have overlapped at some point in history but this can only be demonstrated by detailed somatic comparison of both complements.

Thanks are due to Dr. K. P. Biswas, Superintendent of the Botanical Gardens, W. Bengal, for kindly supplying material from the Darjeeling Gardens, and to Prof. P. C. Sarbadhikari, Head of the Botany Dept., Calcutta University, for affording facilities to carry out observations.

Bose Institute,  
Calcutta, 9  
March 25, 1952.

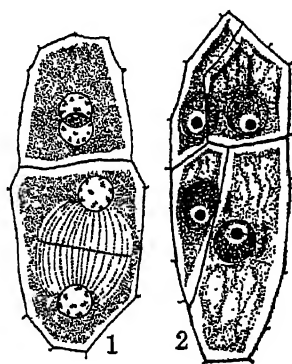
MRIDULA DUTT.

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# OCCURRENCE OF FOUR KINDS OF MEGASPORE TETRADES IN *ELAEIS* *GUINEENSIS* JACQ.

*Elaeis guineensis* Jacq., the African Oil-Palm, has long been known as an important source of oil. It is a native of West tropical Africa and it is grown as an ornamental plant in the Law College Gardens, Poona.

During the course of an embryological study of this plant, some interesting variations were noticed in the arrangement of megaspores. The megaspore-mother cell divides transversely and forms a dyad of two cells. The next division in each of these dyad cells, however, occurs in different planes resulting in four kinds of tetrads. A linear tetrad is formed if both the dyad cells divide transversely. But commonly the micropylar dyad divides in a plane at right angles to that of the chalazal one and forms a T-shaped tetrad (Fig. 1). A case



of an inverted T-shaped tetrad was met with Fig. 1. Two cases were noticed where both the dyad cells divided in a plane parallel to the long axis of the ovule resulting in an isobilateral arrangement of megaspores (Fig. 2). The occurrence of different kinds of tetrads in the same species is of interest and a few such cases are cited by Maheshwari<sup>1</sup> (1950). The details of this investigation will appear elsewhere.

We are grateful to Prof. S. P. Agharkar for his kind and constant interest in our work.

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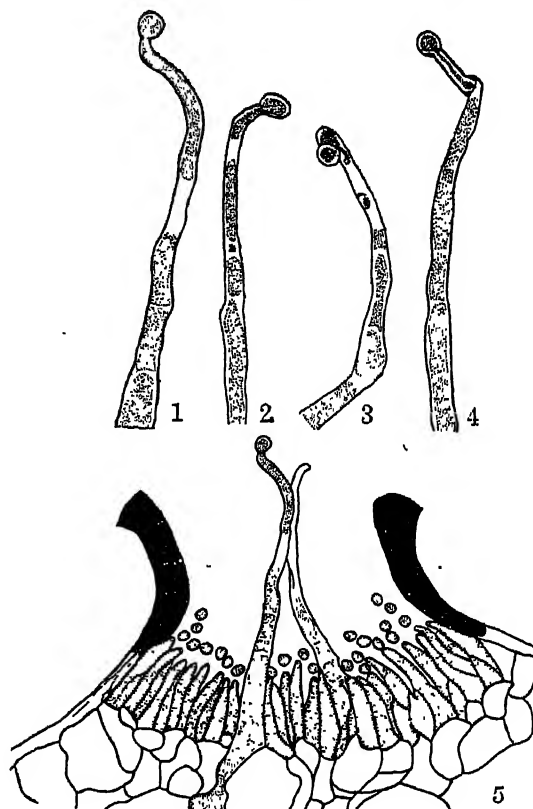
March 28, 1952.

L. B. KAJALE.

S. G. RANADE.

# OCCURRENCE OF FLEXUOUS HYPHAE AND PYCNIOPORE FUSIONS IN *SCOPELLA GENTILIS*

WHILE studying the life-history of the rust—*Scopella gentilis* (Syd.) Mundk. & Thirum. fusions of the flexuous hyphae with the pycniospores were observed in many cases (Figs. 1, 2, 3, 4 & 5). These resemble the "hypha-to-



FIGS. 1, 2, 3, and 4 showing fusions of pycniospores with the flexuous hyphae,  $\times 1,700$ .

FIG. 5. showing a T.S. of a pycnium with the complete length of the flexuous hypha which has also fused with a pycniospore,  $\times 1,000$ .

peg fusion" type described by Buller.<sup>1</sup> The hyphae, when projecting above the apical surface of the pycniosporophores, measure  $45.5-64.5 \times 3.8-5.5 \mu$ . The fusion papilla is not so narrow and constricted as was noted by Buller in *Puccinia graminis*. Only the apical ends of the hyphae fuse with the pycniospores, no cases of side branches developing from the hyphae being observed. In thin sections of the pycnia the continuity of the flexuous hyphae has been traced through the maze of pycniosporophores down to the palisade tissue

1. Maheshwari, P., *An Introduction to the Embryology of Angiosperms*, New York, U.S.A., 1950.

(Fig. 5). In this region they stain deeply with cotton-blue in Lactophenol, indicating the presence of rich cytoplasmic contents. Hyphae which have not fused with the pycniospores are not clearly visible even in thin sections below the pycniosporophores.

The pycnia and the flexuous hyphae of *Scopella gentilis* resemble very much those of *Phragmidium speciosum* and *P. potentillae*, as described by Buller,<sup>1</sup> except that the number of hyphae recorded by him in the latter two rusts varies from two to five. He has also enumerated the occurrence of flexuous hyphae in 51 species of the Uredinales, distributed in 8 genera of the Melampsoraceae, and 6 of the Pucciniaceae. The presence of flexuous hyphae observed in *Scopella gentilis* (Pucciniaceae) adds another instance to the list already known.

The writer is grateful to Prof. S. L. Ajrekar for his kind interest and encouragement, and to Dr. M. J. Thirumalachar for his valuable advice.

Botany Lab. of M.A.C.S., M. M. PAYAK.  
Law College Buildings,  
Poona, March 25, 1952.

1. Buller, A. H. R., *Researches on Fungi*, 1950, 7, xx + 458 pp. University of Toronto Press.

## AERIAL TUBERISATION IN POTATO

THE occurrence of aerial tubers in potato as a result of disease and by removal of natural tubers has been reported at the Agricultural Research Station, Colorado.<sup>2</sup> Apart from the presumption that aerial tuberisation is caused by interception of carbohydrates in its passage from the leaf to the storage region as a result of cankering and girdling on the underground part of the stem caused by disease,<sup>1</sup> no experimental evidence, however, appears to have been adduced so far to locate the exact cause of aerial tuberisation. The following experiments were conducted to meet this end. Seed tubers of Great Scot were planted in pots on 14-9-50 and when the plants were 39 days old, various treatments were given to the several branches of a single plant keeping one or two branches as controls. The following treatments were replicated in three plants growing in separate pots under similar conditions of age and growth:

1. Ringed the stem partially to three-fourth of girth just above the junction of root and stem below ground removing the bark in the cut region entirely.

2. Ringed the stem fully just above the junction of root and stem below ground removing the bark entirely from the cut region.

3. The stem above ground and below first axil ringed fully removing the bark entirely from the cut region.

4. The stem above ground and first axil ringed fully removing the bark entirely from the cut region.

5. The bark and wood cut to half the thickness of stem at a point just above the junction of root and stem below ground.

6. The wood alone dismembered and bark cut to three-fourth of the girth at a point above the junction of stem and root below ground.

7. The main root just below the junction of stem and root dismembered, thus removing all the tuber-bearing stolons but keeping a few regular roots in tact.

After a lapse of 7 to 57 days from the time of operation in the different treatments, aerial tuber formation was observed to take place in different axils in different treatments.

A minimum period of 7 days for the appearance of tuber from the time of operation was noted in treatment 1 in which the treatment was given after 39 days from the time of planting. It may be noted here, that normal tuber formation is known to commence after 45 days from sprouting in Great Scot. In treatment 7 the region of the main stem around the 1st axil from the cut end was found to have slightly enlarged after 16 days from the date of operation. The tubers in treatments 1, 3, 4, 5 and 6 did not develop in size to anything more than a pinhead, whereas, in treatment 2 there was a steady increase in the size of tuber attaining a maximum thickness of 6 mm. at the end of 24 days from its first appearance. Thereafter it ceased to grow and the plant yellowed and died. The swelling of the stem noted in treatment 7 increased in size, finally assuming the shape of a regular underground tuber measuring 19 mm. in thickness. The tuber in the axil on the swollen stem developed, too, but much faster, growing eventually to a size of 25 mm. in thickness.

In treatments 1 and 5 the normal course of carbohydrates through the sieve tubes from the leaf to the underground stem gets partially intercepted, this, probably, resulting in an immediate stimulus being given to induce tuber formation in the axil just above the point of interception. In course of time, perhaps, in an attempt to restore the normal conditions of transportation of carbohydrates, a larger mea-

sure of the burden of translocation is thrown on the existing means of transport through the sieve tubes. This might offer an explanation for the not very appreciable size and rate of development of aerial tubers in these treatments. In treatment 2, the faster and larger development of the axillary tuber is evidently due to a complete interception of the carbohydrates from reaching the underground stem. The subsequent slowing down in the development of tuber in this and the withering of the plant shortly after might be due to the meagre supply of plant food reaching its root system. In treatment 7, on the other hand, the normal functional relationship is maintained between the root and the stem while the synthesised food from the leaf is not made available to the underground tuber-bearing stolons thus affording an unfettered scope for aerial tuber development in this case. This experimental observation indirectly confirms the observations made by Fitch<sup>2</sup> that the removal of the underground tubers results in aerial tuberisation.

Agric. Research Station, P. UTTAMAN.  
Nanjanad, Nilgiris,  
June 21, 1951.

1. Coons, G. H., *Special Bulletin No. 85, Michigan Agricultural College Experimental Station*, 1918. 2. Fitch, C. L., *Bulletin No. 176, Agricultural Experimental Station, Colorado Agricultural College*, 1910.

#### CURARIFORM SUBSTANCES FROM ROOTS OF *CISSAMPELOS* *PAREIRA* LINN.

THE potent alkaloidal ingredients of curare, the well-known South American arrow-poison, have recently assumed increasing importance in medicine as muscle relaxants because of their neuromuscular blocking effect. These alkaloids are distributed among plants of several *Strychnos* species and several genera of *Menispermaceæ*. Bhattacharji, *et al.*,<sup>1</sup> extracted an alkaloid—'hayatin'—from the root of *Cissampelos pereira* Linn., belonging to the genus *Menispermaceæ*. The possibility of using this substance as muscle relaxant was explored. The present paper embodies the results of studies in the curariform properties of hayatin hydrochloride, methiodide and methochloride.

The curariform activity of the alkaloid was tested on anaesthetised (phenobarbitone) dogs whose gastrocnemius muscle was made to contract 12 times per minute in response to electrical stimulation of sciatic nerve. From the

depression of contraction caused by the substance, the curariform potency was assessed. While hayatin hydrochloride was found to have no effect on such preparation, hayatin methiodide and methochloride caused depression of contraction of gastrocnemius to a very great extent. Tested on the same preparations both hayatin methiodide (or methochloride) and *d*-tubocurarine chloride showed equal amount of curariform activity in the same doses. Denervated tibialis muscle from the same limb of the animal, while stimulated directly and simultaneously with the sciatic-gastrocnemius preparation showed slight depressant effect on the muscle contraction on administration of both hayatin methiodide and *d*-tubocurarine chloride proving that the substance acts by neuromuscular blockage. Like *d*-tubocurarine the curariform activity of the substance can be antagonised by prostigmin. Tested on rabbits, the head-drop dose for hayatin methiodide was found to be 0.110 mg./kg. (13 experiments), whereas the dose for *d*-tubocurarine chloride was found to be 0.14 mg./kg. (10 experiments).

Hayatin methiodide and methochloride produce a fall of blood pressure which is prevented by the antihistamine drug 'Phenergan' (Promethazine).

Hayatin methiodide in smaller doses at first depresses and then stimulates respiration both in frequency and amplitude and in higher doses paralyses it. No definite action has been found on intestine or uterus.

Depression of blood pressure following stimulation of vagus and contraction of nictitating membrane following stimulation of preganglionic fibres of superior cervical ganglion after administration of hayatin methiodide show that it has got no blocking effect on para-sympathetic or sympathetic ganglia.

Acute toxicity of the drug was tested on albino rats (80-120 gm.). LD<sub>50</sub> was calculated to be 0.31 mg./kg.

Hayatin methiodide (and methochloride) possesses almost an equal degree of curariform activity as compared with that of *d*-tubocurarine chloride but the fall of blood pressure, respiratory depression and autonomic blocking effect appear to be less marked. Further studies are in progress.

Centrl Drug Res. Institute, S. N. PRADHAN.  
Lucknow. C. ROY.  
K. S. VARADAN.

1. Bhattacharji, S., Sharma, V. N. and Dhar, M. L., *J. Sci. Ind. Res.*, 1952, V.IIB, No. 2, 81.

## REVIEWS

**The Chemistry of Synthetic Dyes, Volume I.**  
By K. Venkataraman. (Published by Academic Press), 1951. Pp. xvi + 704. Price \$14.50.

The chemistry of synthetic dyes forms a large and important part of organic chemistry and most of the interesting earlier developments in synthetic organic chemistry have taken place from this branch. Besides its innate attractiveness, its relation to an important key industry accounts for its great progress and for its vastness. These features are brought out in the pages of the volume under review, which is the first of two volumes providing a comprehensive treatise on the subject. The treatment includes not only the chemistry of intermediates and dyes but also the application of dyes, the relation between colour and chemical constitution, the action of light on dyes and the chemical constitution of dyes in relation to their affinity for textile fibres.

The author is a well-known investigator and has made a large number of important contributions to this field. He has brought to bear on his task his experience of the past three decades as a researcher and as a teacher. He has travelled widely in Europe and America and has had excellent opportunities of obtaining first-hand information about the Dyestuffs Industry in Germany. All available sources of information have been used. The book however, is not a mere collection of all that has been said and written, but provides a balanced and critical account which is up to date.

The claim to comprehensiveness is fully justified by the contents of the first volume with 22 chapters. The introductory chapter gives not only a brief history, but also deals with 'Industrial Organisation', 'Chemical Engineering Aspects' and 'Names of Commercial Dyes'. The raw materials and intermediates are dealt with in the following three chapters. The salient features of the chemistry of each group (e.g., quinones) are briefly, but fully presented. Chapter VI on the application of Dyes is highly valuable. The theoretical discussion of colour and constitution covering about 80 pages is full and clear. Though the account has to be brief, just those details and items of general information are discerningly given that will enable the student to follow the

discussion without difficulty. The second half of the book deals with the dyes proper and gives a comprehensive account of azodyes and related groups.

The book is eminently readable and meets fully a real need not only of those specialising in the chemistry of synthetic dyestuffs, but also of the larger group working in organic chemistry, who will find it handy for reference on various occasions. The printing and get-up of the volume are excellent and it is remarkably free from errors.

T. R. S.

**Prism and Lens Making.** By F. Twyman. (Hilger and Watts Ltd., Hilger Division, 98 St. Pancras Way, London, N. W. 1). Price 5s. 1s. Postage 1 sh. extra.

As the second edition of an earlier publication of 180 pages in 1942, the present volume has expanded to about 630 pages in 1952. This indicates the very considerable volume of new information not included in the first edition and not available in any other publication.

The use of Indian ink as a polishing medium for the final stages on glass or metal and the use of fine glass powder with which to finish the fine grinding of metal mirrors are typical of the new information published perhaps for the first time. Even so can be said to be the case of tests using the capillary rise of liquids for deciding the shape of flats being ground together when spherometer controls fail to indicate the departure from flatness in the last stages of the grinding. The publication of the data on a Fizeau Interferometer using a liquid surface as an absolute flat is most useful. This idea of Lord Rayleigh in 1893 was utilized by Waran for a parallel plate interferometer in the year 1919. So it is not as if the high degree of planity provided by viscous liquid surfaces "has had surprisingly little application so far".

The first edition had left even advanced workers in doubt in many places. The enlarged second edition certainly overcomes this defect. No longer can it be said that a manufacturing firm cannot be expected to divulge in such publications all their processes and trade secrets. The firm of Hilger has reached such a high standard that by this publication they can be said to have thrown a challenge to the other

works to come out into the open with their methods for the ultimate benefit of science depending on quality optical instruments in many fields. What is really valuable stands protected by patents, e.g., the Twyman and Green Interferometers now used by all advanced manufacturers.

Though the war years 1914-18 and 1939-45 saw remarkable progress in the optical field when binoculars, range finders, and aerial cameras were needed in thousands, lone workers in the field have been feeling the lack of guiding literature in any quantity. This was perhaps responsible for Deve's "Optical Workshop Principles" a translation from French brought out as a Hilger publication in 1943. Beginners however will do well to start guided by a simpler publication like the monograph in optics "Spectacle Lenses" by P. Hariharan, an Indian publication of remarkable lucidity, the reason being that all optical processing appears so mysterious to the uninitiated. Even when assisted by such literature one will find on actual trial that many an experience has to be bought dearly only in the school of trial and error. Several pieces have to be worked patiently before confidence to turn out work of any quality and precision gets established. Then one will be tempted to agree with Twyman that no two glasses behave in the same way when the attempt is to produce regular surfaces of a precision reckoned in fractions of a wavelength of light. Each piece is a problem by itself, where one has to be satisfied by reaching a close approximation to the desired perfection. This is characteristic of the opticians' art as of all other arts.

A process worked out for quantity production in a large factory involving serious outlay on many machines, tools and accessories is at times almost incomprehensible and somewhat useless to the lone worker. He can manage many a precision job by the skill of his hand using but the simplest of mechanical accessories if he judiciously uses them with a scientific understanding of all the factors involved. Whenever stuck over a difficulty a reference to a standard text-book is often so illuminating and helpful as he can always pick up useful ideas discussed in the book. On this point this book is very helpful because of the wealth of data supplied as works' experience covering many aspects.

The book is by no means easy reading. There are difficult chapters like the one on interferometers likely to baffle one who has not got a daily acquaintance with costly interferometers. Even when so voluminous, it is not without its

omissions. Thus the measurement of aberrations by Foucault tests which lone workers like the reviewer find so useful in figuring large paraboloids for telescopes, finds no mention at all, though mention is made of the latest optical triumph the 200" telescope at Mt. Palomar. Excellent pictures of Newton, Foucault, Michelson, and Schimdt, who can be said to be the guiding spirits of the present-day optical art, add a personal charm all its own to this very useful technical book.

H. P.

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**Radio Astronomy.** By B. Lowell and J. A. Clegg. (Chapman & Hall), 1952. Pp. 238. Price 16 sh.

This book is part of the newly started series of scientific publications, known as "Frontiers of Science", the aim of which is to "fill the gap between the very elementary expositions and the specialist text-books".

The subject of Radio Astronomy was born some twenty years ago, but it did not grow up until the post-war years. It owes its rapid development since 1945 mainly to the refined techniques in radio and radar evolved during the war. Many like the reviewer, who are not specialists in the field, would have only some vague ideas that radio waves have been detected from the sun and from regions of the galaxy and that radar echoes have been obtained from meteors and from the moon. It is fascinating to learn from this book that a vast amount of information has been obtained from such studies and that completely new avenues have been opened up for the exploration of the universe.

Meteors take up about one-third of the book. The main problem in this case is to decide whether they originate in the solar system or in interstellar space. Both the radiant as well as the velocity of the meteors are amenable to study by radar echoes. Although not absolutely conclusive, there seems to be very little doubt now that they do not come from outside the solar system. Incidentally, the radio method has revealed the existence of intense daylight showers which had escaped visual observation earlier.

The detection of radio emission from the sun of an intensity some million times that to be expected on the basis of thermal radiation has raised many interesting problems to be solved as regards their origin. It appears that there are regions in the sun, particularly near sunspots, where potential differences of the order of  $10^5$  V. exist. Radio waves are also being

emitted by the galaxy. This was detected as early as 1931, but the most exciting discovery is the one made by Bolton and Stanley in 1948 of the so-called "radio stars" in the region of Cygnus which has an angular diameter less than 8 minutes of arc and which is an extraordinarily intense source of radio waves. Several other radio stars have since been observed, but their explanation is far from clear because these regions are generally devoid of any outstanding visible objects.

A fascinating book, although not so elementary as the authors make it to be, it can be read with profit by anyone acquainted with fundamental physical concepts. The printing and get-up of the book are excellent, and considering its size and quality, the price is quite reasonable.

G. N. R.

**The Sugar Industry—1950 Annual.** Edited by M. P. Gandhi. (Gandhi & Co., Sir Pherozshah Mehta Road, Fort, Bombay), 1951. Pp. xvi + 156. Price Rs. 6 net.

The 1950 annual on the Indian Sugar Industry compiled and edited by one of our distinguished economists intimately connected with the industry, constitutes one of the most authoritative sources of information on the scientific, industrial and economic aspects of the subject. The annual generally follows the plan analogous to that of previous issues. There are, however, a few helpful changes and additions made in the present volume. "Like the new sugar policy of the Government of India, we have also re-orientated this year the method of presentation of facts, statistics, and comments relating to the industry. Unlike our past *annuals*, the present one is divided into chapters, and detailed contents both of the matter as well as of tables have been provided to facilitate quick reference. Many tables on estimated valuation of sugarcane production, sugar consumption, *per capita* consumption and imports of sugar, cost of cultivation, etc., are provided. We have made new additions to World Sugar Industry statistics giving a comparative study. So also we have tried to give comprehensive information on sugar industry in different States in India and Pakistan, and on labour in the sugar industry as well as on labour legislation, etc." We have no doubt that this annual which has established a reputation for itself will receive the continued

patronage and attention of a large circle of readers interested in what is now regarded as one of the most important of our National Industries.

**The Chemical Activities of Bacteria.** By Ernest F. Gale. Third Edition. University Tutorial Press Ltd., London. (Oxford University Press, Madras-2), 1951. Pp. 213. Price Rs. 7-12-0.

The subject of the chemical activities of bacteria is a comparatively new discipline first conceived and pioneered by Majory Stephenson at the Cambridge School of Biochemistry under the inspiring guidance of Hopkins. The author, whose own contributions to this fascinating and fruitful field have been both brilliant and substantial, has rendered a great service to this rapidly developing subject by presenting this introductory treatise, which will not only prove useful to students of bacteriology and biochemistry but also inspire research workers to advanced effort in this field.

The author has taken advantage of the third edition to bring the volume up to date and revise the subject in the light of recent developments. For example, "during the last three or four years considerable advances have been made in our knowledge of synthetic systems and their control in the bacterial cell by genes". Elegantly got up and moderately priced, this volume will be widely accepted by bacteriologists and biochemists as an illuminating contribution to the subject.

**Literature Review on Fats and Oils, 1949.** (Published by the C.S.I.R., New Delhi), 1952. Pp. 32.

The review contains a summary of literature published in Indian and Foreign periodicals during the year 1949. Important aspects like production and technology of oils, hydrogenated oils and other edible fats, their nutritive value, keeping quality and methods of analysis have been dealt with in detail. The review should prove useful to all engaged in this wide field of perennial interest. The value of the publication would no doubt have been greatly enhanced if it had been brought out in good time like the well-known reviews on the same subject published by the Society of Chemical Industry and the American Oil Chemists' Association.

N. N. DASTUR.

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## SCIENCE NOTES AND NEWS

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### *Psara phaeopteralis*, Guen.-A Sugarcane seedling pest

Shri G. Narasimha Rao, Sugarcane Breeding Institute, Coimbatore, writes as follows:—

The occurrence of the Pyralid moth, *Psara phaeopteralis* Guen., in South India, was reported as early as 1926 by Cherian who recorded it as a pest of fodder grasses. During the past two years, it was observed that larvae of this Pyralid were destroying in large numbers young sugarcane seedlings grown in pans at this Institute. This is the first record of its damage to sugarcane seedlings. It is interesting to note that only seedlings well under 3-4 inches in height are ravaged, while the vigorous and taller seedlings are relatively free from their attack.

### Suitability of Indian Glass Containers

With a view to examining the suitability or otherwise of Indian-made containers and analysing the causes of their shortcomings, the Central Glass and Ceramic Research Institute recently organised a discussion inviting representatives of glass, chemical, pharmaceutical, food preservation, toilet, cosmetic and other allied industries, also scientists and technologists, so as to bring together the producers and consumers of glass containers.

A Committee has since been formed with Dr. Atma Ram, Director, Central Glass and Ceramic Research Institute, as Chairman, and Messrs. K. N. Desai, S. P. Sen, M. L. Schroff, B. N. Maitra, B. Sircar, S. Ghosh, S. Niyogi, S. N. Ghosh, U. P. Basu, and Y. P. Varshney, as Members to work out ways and means of tackling this important problem.

### Indo-U S. Technical Co-operation for Fisheries Development

According to an operational agreement signed recently between the Government of India and U.S.A., more than a crore of Rupees will be made available by the latter for the expansion and modernisation of marine fisheries in India. The purpose of the project is to bring about an increase in the quantity of marine fishery products through improvements in the existing fishing crafts and methods of

capturing fish, discovery and exploitation of new fishing grounds in offshore waters, testing of the different types of crafts and gear not now in use but which are likely to be successful in Indian waters, training of Indian personnel in modern fishing methods and improvements in the methods of preservation and transportation of fish.

### Kalinga Prize Award

The Kalinga International Annual Prize for the best work in the field of popularization of science, was awarded to Prince Louis de Broglie in a ceremony at Unesco House, Paris. Prince de Broglie is internationally famous both for research in theoretical physics (Nobel Prize, 1929) and for pioneer achievements in the popularization of science. He is the Honorary President of the French Association of Science Writers and the permanent Secretary of the French Academy of Sciences.

### Indian Technical Assistance to S.E. Asian Countries


The Government of India have decided to offer, during the current year, 55 scholarships and fellowships to students from South and South-East Asian countries for training in India under the Technical Co-operation Scheme of the Colombo Plan. The scholarships, valued roughly at about Rs. 6 lakhs, are for training in degree and diploma courses as well as for post-graduate study and will continue for a period between two to four years, according to the curriculum chosen.

The training facilities would be provided in Indian Universities and in the specialised institutions in the country. The countries to which allocation for training facilities are being made include Burma, British Borneo, Ceylon, Indo-China, Indonesia, Malaya, Nepal, Pakistan, Philippines and Thailand.

### Botanical Society of Bengal

At the Annual General Meeting of the Society held recently, the following Office-bearers were elected: *President*: Dr. J. C. Sen Gupta; *Vice-Presidents*: Dr. K. P. Biswas, Prof. P. C. Sarbadhikari *Hon. Secretary*: Dr. N. K. Sen.





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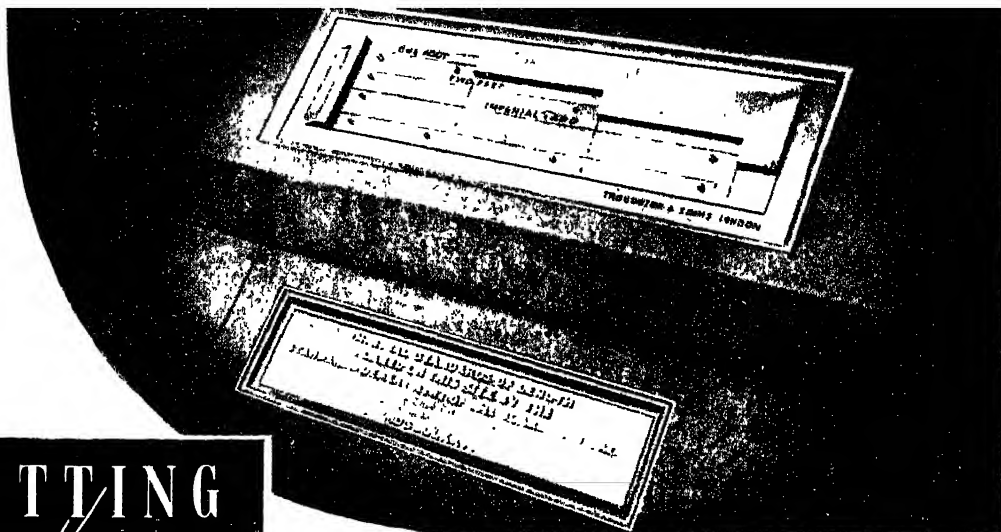
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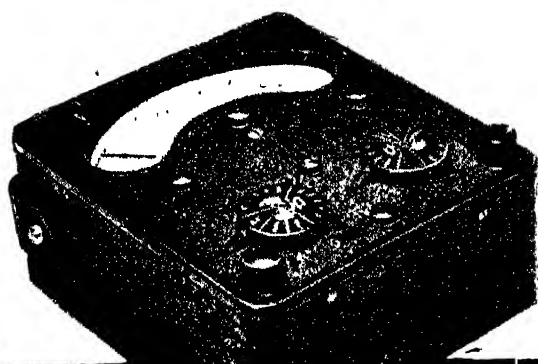
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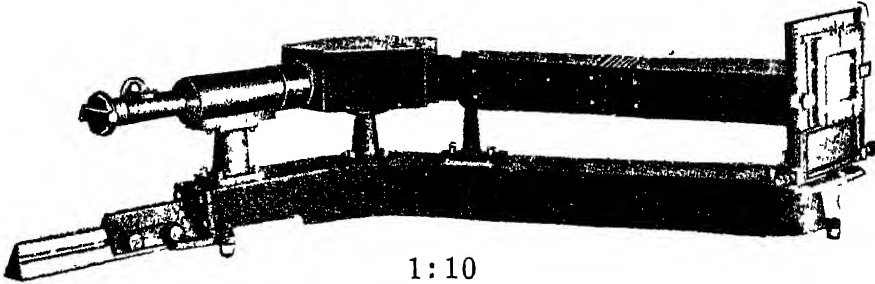
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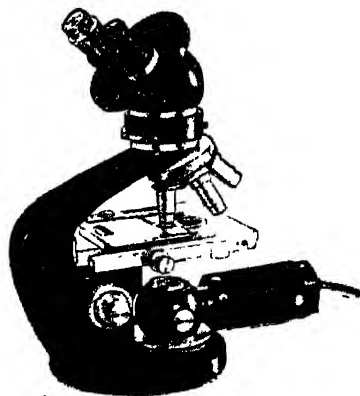
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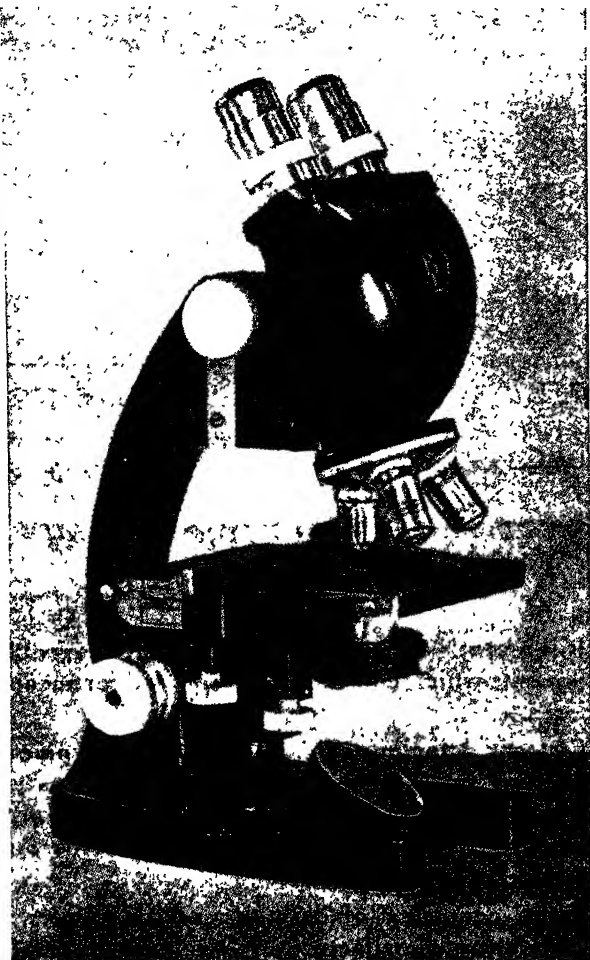
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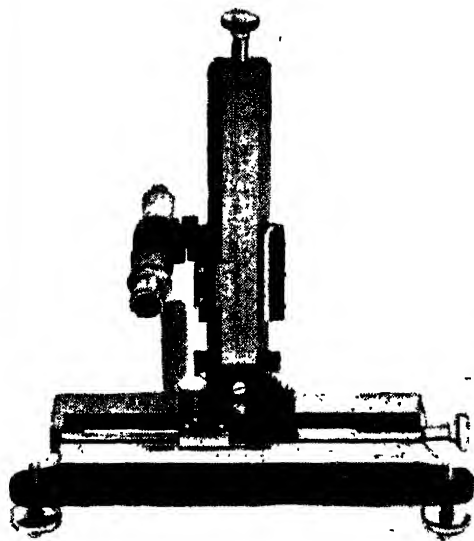
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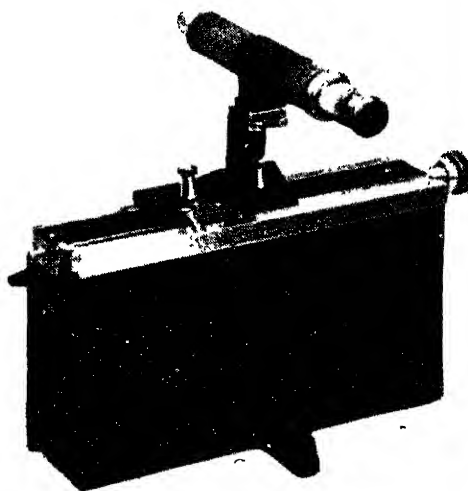
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## ROYAL INSTITUTE OF CHEMISTRY

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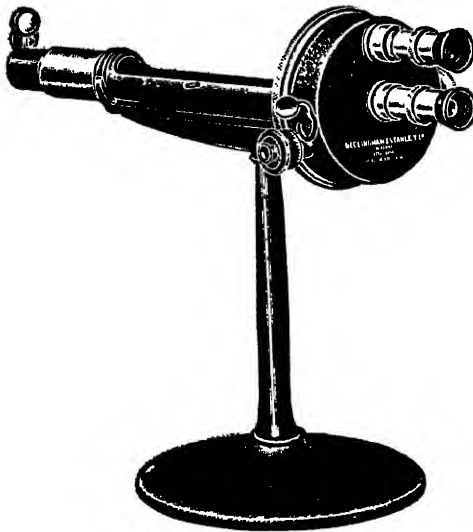
An Examination for the Associateship of the Royal Institute of Chemistry will be held in Bombay in the latter half of January, 1953. Forms of application for permission to enter may be obtained from the Registrar, Royal Institute of Chemistry, 30, Russell Square, London, W.C. I, and must be returned to the same address not later than 30th September, 1952.

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# Current Science



Vol. XXI]

JULY 1952

[No. 7

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## INTERNATIONAL LABORATORIES FOR RESEARCH

THE spirit of science being in the truest sense international, co-operation among scientists in different countries is no doubt the condition essential for progress. But it would appear that such co-operation as exists today among scientists by way of free exchange of ideas and information pertaining to research, is hardly enough. For, there have emerged research projects in many branches of science which are well beyond the resources of any one country to put through. We have, in fact, lighted on an era in science when several countries may have to pool together their resources for the creation of Central Laboratories to carry out these special programmes of research. It is, therefore, very gratifying to learn that the UNESCO have taken some pioneering steps in the formation of such international centres of research. The details of the historical picture leading to these developments are indeed worth recording.

The basic aspects of this problem were studied, following the decision of the Economic and Social Council in 1946 inviting the Secretary-General of the United Nations, Research

Laboratories. An extensive enquiry was made by the Secretary-General, and in 1949 a Committee of Experts from the UNESCO and the United Nations examined the results of this enquiry and recommended the following priorities in the field of natural sciences: first priority—computation centre, brain institute; second priority—astronomical laboratory, institute of biochemistry, meteorological Institute, research laboratory on arid zones.

The convention for the setting up of the International Computation Centre, comprising three main functions in the fields of research, education and service, was signed on the 6th December 1951, by eight countries: Belgium, Egypt, Iraq, Israel, Japan, Mexico and Turkey. There were several offers from the member-States of the UNESCO for the location of the Centre, and it was decided to establish the Centre in Rome, where the Italian Government offered a wing of its National Research Council building, and agreed to lend the Centre \$75,000 free of interest for ten years. All the library and documentation facilities of the National Research Council have been placed at

the disposal of the Centre whose annual budget of \$ 100,000 is to be made up from the contributions of its member-States. For the first year, UNESCO will give the Centre a grant of \$ 15,000 and a loan of \$ 60,000.

As a result of the co-operation offered by the European States, there has been another promising development towards international collaboration. At the General Conference of the UNESCO in Florence in June 1950, Professor I. I. Rabi proposed on behalf of the United States delegation that UNESCO should make a preliminary study of the possibility of setting up a West European Physics Laboratory for High Energy Particles. Professor Pierre Auger, Director of the Department of Natural Sciences of the UNESCO, submitted a report and it was discussed by a Committee of Experts convened by the UNESCO.

A conference of about 60 delegates from 12 European countries examined the plan prepared by the UNESCO in regard to the equipment and structure of the Laboratory, the creation of an Institute for Advanced Studies in Nuclear Research, the organization of the work including the creation of study groups in various countries and liaison with the governments taking part in the work. It also estimated the cost of studies to be undertaken during 1952 and considered the establishment of the list of States willing to participate in the work and the calculation of their financial contributions. Following another meeting in February 1952, a Council of Representatives has been set up with

Headquarters in Geneva which will be responsible for the establishment of the Laboratory and the organization of other forms of co-operation in nuclear research.

Twelve States have signed the agreement constituting the Council. The Secretary of the Council is Professor E. Amaldi (Italy). The heads of the study groups are: construction of a synchro-cyclotron for energies of at least 500 Mev—Professor C. J. Baker (Holland); construction of a cosmotron with energy exceeding 1 Bev.—Professor O. Dahl (Norway); organization of an International laboratory for nuclear research—Dr. L. Kowarski (France); theoretical studies to be set up in Copenhagen—Professor Niels Bohr (Denmark). Without prejudice to the ultimate location of the laboratory, the synchro-cyclotron of the University of Liverpool of 400 Mev will be made available for work on an international basis during 1952.

Examples such as the above are well worthy of emulation by comparatively under-developed countries like ours. Nations occupying contiguous areas can advantageously co-operate in establishing common centres of research on problems of mutual interest, thus avoiding the unnecessary expense in duplication. It is to be hoped that such practice would become the normal mode of planning in the near future, with a view to achieve through co-operation what should obviously be impossible by acting severally.

#### I. C. A. R. GRANT TO *CURRENT SCIENCE*

ON behalf of the Current Science Association, may we take this opportunity to express our grateful appreciation of the generous gesture of the Indian Council of Agricultural Research in sanctioning to the

Association a subsidy of Rs. 2,000 each, for the years 1950-51 and 1951-52 towards the cost of printing *Current Science*?

M. SREENIVASAYA.  
Secretary.

#### ROYAL INSTITUTE OF CHEMISTRY

THE Associateship of the Royal Institute of Chemistry is a well recognised professional qualification, being the equivalent of a First or Second Class Honours Degree of a British University. It is, therefore, a pleasure to announce that in response to many requests from India, the Council of the Royal Institute of Chemistry have decided to hold an examination

for the Associateship in Bombay in the latter half of January 1953. Forms of application for permission to enter may be obtained from the Registrar, Royal Institute of Chemistry, 30, Russell Square, London, W.C.-1, and must be returned to the same address not later than 30th September 1952.

## A NEW COALFIELD IN THE SIKKIM HIMALAYA

A. M. N. GHOSH

Geological Survey of India

NEW light on the structure of the Himalaya in Sikkim and the Darjeeling District is thrown by the discovery, in the metamorphic terrain of the Lesser Himalaya in south-western Sikkim, of coal-measures of Lower Gondwana age. The rocks occur isolated from the Gondwana exposures of the southern foot-hills of the Darjeeling Himalaya and occupy an area of 40-45 square miles in the Rangit valley, about 12 miles north of Darjeeling. The Sikkim Gondwanas are exposed in the form of a *window*, the frame of which is provided by the older Baxa and Daling rocks lying in an inverted sequence along with the former.

Coal-bearing rocks have not been so far known to occur north of the main body of the Gondwana outcrops, stretching interruptedly along the foot-hills of the Outer Himalaya between Nepal on the west and Assam on the east where also, in the submontane region, the normal sequence of beds is reversed, the Gondwanas having been overlain by the Baxa and the Daling rocks and underlain by younger Tertiaries. It is only in the Great Himalaya in northern Sikkim that the Lachi series, considered by Wager to be equivalent to the Damuda series of the Lower Gondwana, rests in a normal sequence on the Mount Everest limestone series, which is correlated with the Baxa series of the Outer Himalaya. The Mount Everest limestone series in its turn rests on the Mount Everest pelitic series, which is considered to be equivalent to the Daling series lying much further south in the Sikkim and the Darjeeling Himalayas.<sup>1</sup>

The Rangit valley coal-measures consist of light and dark grey, gritty and felspathic sandstones, carbonaceous slates and semi-anthracitic coal and have at their base tillite and varved slates in which are embedded various sizes of rounded, elliptical and semi-angular pebbles and boulders of gneiss, granite, quartzite, phyllite, chert and limestone. A thick pebble bed of this nature has been recorded by Wager in his Lachi series at a height of over 18,000 feet above the sea level.<sup>2</sup> At various times and at various places a similar pebble bed has been observed at the base of the Gondwanas of the Outer Himalaya. The 'pebble bed' is now generally regarded as equal to the glacial Talchir boulder bed at the base of the Lower Gondwana beds

of the Indian peninsula.<sup>3</sup> The widespread unconformity at the base of the Himalaya Gondwanas is not, therefore, in conformity with the suggestion that the Dalings represent a metamorphosed portion of the Gondwanas.<sup>4</sup>

At one place north of Namchi, at a height of about 5,500 feet the 'pebble bed' yielded *Spirifer* and fragments of other Permo-Carboniferous marine brachiopod and bivalve casts and shells. It may be recalled that Wager has recorded *Spirifer* and other Permo-Carboniferous marine fossils in his Lachi series.<sup>5</sup> The presence of *Spirifer* amongst the marine fossils near Namchi suggests a southerly transgression of the Lachi sea in Permo-Carboniferous times.

A number of coal seams have been traced, some for a few feet and others over tens of yards, both on hilltops as well in the beds of the Rangit river and its tributaries, suggesting that the reserves are fairly large. The thicknesses of the seams vary from four feet to nearly twenty-five feet. Compression has rendered the coal hard and stony at places while shearing has rendered it flaky, powdery and soft at others. Vitrain bands in the coal have a shiny metallic appearance like graphite. Proximate analysis of samples of coal collected from different localities yielded the following variation of the percentages of moisture 3.14-6.31, volatile matter 6.40-11.84, ash 15.34-24.92, and fixed carbon 59.78-70.30. The Fuel Ratio ranges between 5 and 10 and is within the limit obtained in the case of the Gondwana coals elsewhere.<sup>6</sup> The coal-measures are traversed by mica-lamprophyre sills and dykes, which have been subjected to considerable alteration by serpentinitisation. Where they have cut the coal seams the coal has been converted into a natural coke. Similar dykes and sills are present in the Raniganj and Jharia Coalfields as well as in those of the Outer Himalaya. So far no such basic intrusions have been noticed in the Tertiary rocks of the Outer Himalaya in the Darjeeling District. There is also evidence of the existence of a post-Damuda granite in the Rangit Valley, where Tertiary rocks are absent altogether.

All around the coalfields the sequence of the rocks is inverted, the older beds resting on the younger. Owing to multiple folding and overturning of the beds the sandstone, slates,

coal and tillite as well as the older Baxa and the Daling rocks are found at all heights in the valley sections. Coal seams are present near the summit of a ridge at an elevation of 5,600 feet or over as well as in the bed of the Rangit river at about 1,000 feet above the sea level. The amount of dip ranges between  $15^{\circ}$  and  $80^{\circ}$ , although usually it lies between  $30^{\circ}$  and  $45^{\circ}$ . The direction of dip varies from east to north-east on the eastern and from west to north-west on the western side of the Rangit river. Such variation in dip and strike of the inverted strata is due to transverse folding of a gigantic recumbent anticlinal structure.

In a number of isolated sections along the foot-hills of the Darjeeling Himalaya striking examples of the overturning of folded Gondwana beds as well as of quartzites of an older age are noticeable. These sigmoid folds indicate that both the Gondwanas and the older schists and gneisses were simultaneously involved in the post-Gondwana orogenic movements that folded the rocks together first, and later overturned them. It appears, therefore, that the Himalaya in Sikkim and Darjeeling is formed by the rolling of pre-Tertiary formations into overfolds and the piling of gigantic recumbent

folds one upon another. So far two such overfold units have been recognised, one comprising the large nappe of the Darjeeling Hills in the south and the other the *para-autothous* recumbent fold of south-western Sikkim on the north. Such structural interpretation is in agreement with the feature observed in the metamorphic rocks of the Lesser Himalaya in Sikkim and of the Outer Himalaya in the Darjeeling District where, as a result of post-metamorphic folding highly metamorphosed rocks rest on less metamorphosed ones indicating an inversion of the isograds.<sup>7</sup> It is only at the northern limb of the earth flexure that the normal order of superposition of the beds is present in the Great Himalaya, where a gradual vertical uplift imposed a gentle to moderate northerly dips to the metamorphic rocks and the Upper Palaeozoic and Mesozoic rocks of the Tethyan geosyncline.

1. "Everest 1933," 1934, 335 and *Rec. Geol. Surv. Ind.*, 1939, 74, 186.
2. *Rec. Geol. Surv. Ind.*, 1939, 74, 175-78.
3. *Ibid.*, 1935, 69, 155.
4. *Quart. Journ. Geol. Min. and Met. Soc. Ind.*, 1947, 118.
5. *Pal. Ind. (N.S.)*, 31, Mem. 1, 1-19.
6. *Curr. Sci.*, 1943, 15, 347.
7. *Proc. Ind. Sci. Congr.*, 38 Session, Pt. 3, 111.

## PROMOTION AND SAFEGUARDING OF THE INTERESTS OF SCIENTISTS IN INDIA

ONE of the objects for which the National Institute of Sciences of India was founded was the promotion and safeguarding of the interests of scientists in India.

At the Annual General Meeting of the National Institute, held on 5th October, 1951, at Delhi, attention was specially invited to this aspect of the work of the Institute. It was pointed out then that, although the number of scientists has increased in recent years, the quality of an average Indian scientist appears to have deteriorated, and its cause was attributed to lack of "scientific atmosphere". Official procedures, social or economic conditions seem to have contributed to this downward tendency. As a matter of fact, when science is receiving great attention in India, the scientist, as an individual, is perhaps being neglected.

To study the causes of the above and to re-

port on matters that will conduce to the promotion and safeguarding of the interests of scientists in India, a Fact-Finding Committee was appointed by the Council of the Institute in January, 1952. To facilitate their work, this introductory note is published with the object of focussing the attention of scientists to this matter. Scientists are, therefore, requested to communicate their views to Dr. S. L. Hora, 1, Park Street, Calcutta. It is not intended to take up any individual cases, but specific cases might be given to substantiate a point of view.

It may be noted that all information collected in response to this note will be treated as strictly confidential and will be utilized only for formulating proposals. It is hoped that all will co-operate in communicating their views on this matter of vital importance to scientists in India.



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BOND MOMENTS AND INDUCED  
MOMENTS

For the calculation of the magnitude of the induced moments in the non-polar parts of a molecule caused by induction from a primary dipole Groves and Sugden<sup>1</sup> outlined a method which was later applied by Thomson<sup>2</sup> in elucidating the structure of methyl and ethyl carbonates from their dipole moments. Recently Gent<sup>3</sup> has used this method in discussing the dipole moments of dimethyl ether and other ethylene oxide homologues. It is the object of the present note to discuss critically certain assumptions involved in the derivations of Groves and Sugden and to modify their equations in order to achieve more consistency with available data.

Following Frank<sup>4</sup> the induced moment  $\mu_{is}$  along the axis of the primary dipole of moment

$\mu$  for an atom or group of volume  $\delta v$  is given by  $\mu_{is} = [\delta V (\epsilon - 1) / 4\pi] [\mu (3 \cos^2 \theta - 1) / \epsilon_0 r^3]$ . (1)

The component of the induced moment normal to the axis of the primary dipole is given by  $\mu_{iv} = [\delta V (\epsilon - 1) / 4\pi] [\mu (3 \sin \theta \cos \theta) / \epsilon_0 r^3]$ , (2)

where  $\epsilon$  = intra-atomic dielectric constant,  $\epsilon_0$  = intra-molecular dielectric constant,  $\theta$  and  $r$  refer to the polar co-ordinates of the centre of the atom or group. In order to arrive at an expression for  $\delta V$  Groves and Sugden used the relation  $\delta V = \frac{M}{N \cdot d}$  obtained in the following manner.

$$\frac{R}{N} = \frac{\epsilon - 1}{\epsilon + 2} \cdot \frac{M}{N \cdot d} = \frac{4}{3} \pi a$$

or

$$\delta V = \frac{M}{N \cdot d} = \frac{4}{3} \pi a \cdot \frac{\epsilon + 2}{\epsilon - 1}, \quad (3)$$

where  $R/N$  denotes the refraction of the atom or group and  $a$  its polarisability. It will be

easily seen that the value of  $\delta V$  thus obtained does not represent the volume of an atom or group but includes "free space" as well. Since it is essential in the application of Groves and Sugden's method to assume the atom or group concerned to be a sphere of uniform polarisability we may write  $\delta V = 4\pi/3 r_a^3$ , where  $r_a$  is the radius of the atom or group as the case may be. Substituting this expression for  $\delta V$  in equations (1) and (2) and following the same procedure as outlined by Groves and Sugden, we get

$$\mu_{ix} = \frac{\epsilon-1}{3\epsilon_0} \cdot \sum A_x \frac{r_a}{\pi r_2} \quad (4)$$

and

$$\mu_{iy} = \frac{\epsilon-1}{2\epsilon_0} \sum A_y \frac{r_a}{\pi r_2}, \quad (5)$$

where  $\sum A_x$ ,  $\sum A_y$  and  $r_2$  have the same significance as given by Groves and Sugden. The equations for  $\mu_{ix}$  and  $\mu_{iy}$  obtained here differ from those of Groves and Sugden by a ratio  $\frac{\epsilon-1}{\epsilon+2} \frac{r_a^3}{a^3}$ . For  $\epsilon=2$ , this ratio becomes  $\frac{r_a^3}{4a^3}$ .

A very significant failure<sup>7</sup> of the equations of Groves and Sugden has been in the evaluation of the bond moments of C—O and C=O (2.30 D and 2.28 D respectively). Using the equations derived here the values of these bond moments have been evaluated from the dipole moments of dimethyl ether, methyl alcohol, acetone and acetaldehyde. The results are set out below.

C—O Bond moment		C=O Bond moment	
Dimethyl ether	1.57 D	Acetone	2.42 D
Methyl alcohol	1.07 D	Acetaldehyde	2.27 D

In the calculations of the bond moments of C—O and C=O given above, a value 0.4 D for the C—H bond moment has been taken. It will be seen that the equations derived by the author for the values of the induced moments in atoms or groups assumed to be spheres of uniform polarisability yield consistent results. It is also to be noted that, in general, the values of the induced moments obtained by the present method are much less than those obtained by the method of Groves and Sugden and thus the values of the bond moments differ accordingly. In many cases, as for example, those considered here, it is clear that the bond moments calculated by the present equations vary in different molecules. This is only to be expected if one takes into consideration the variations of

the distribution of charges and length of a bond in different molecules. Despite the obvious limitations of any treatment of the induced moment problem, it is clear that the present method is quite satisfactory on account of its internal and external consistency.

The author's grateful thanks are due to Prof. R. S. Krishnan for his kind interest in this work.

Dept. of Physics, P. T. NARASIMHAN,  
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## RUSSEL EFFECT AND PHOTOGRAPHIC EMULSIONS

As mentioned by the author in two previous notes,<sup>1</sup> extremely long exposures ranging from 24 to 48 hours were found necessary to obtain tolerably clear 'Russel Images' on the photographic emulsion used. The present note reports the results of a study of Russel effect, using different types of photographic emulsions.

The following types of photographic plates were tried: (1) Infra-red process; (2) HP3; (3) Special rapid panchromatic; (4) Rapid process panchromatic; (5) Selochrome; (6) Chromatic; (7) Zenith supersensitive; (8) Special rapid; (9) Process; (10) Fine grain ordinary.

The results obtained were surprisingly interesting. In the case of the infra-red process plate and the different types of panchromatic plates (2, 3 and 4), no impression was recorded on the emulsion. In the case of the two orthochromatic plates (5 and 6), faint impressions without any details, very similar to fog, were obtained. With the non-colour sensitive plates (7, 8, 9 and 10), however, the images were both clear and sharp.

The results of the experiments show: (1) The action exerted by wood on photographic emulsions seems to be of a purely chemical nature, and cannot be said to depend on the photographic speed of the emulsion employed. (2) The addition of certain dyes to extend the spectral range of sensitivity of the emulsion and increase its speed appears to retard the action and even stop it. It seems probable that the oxidising substances responsible for the photographic

activity either attack the sensitising dyes in preference to the silver salts or exert no action on the silver salts in the presence of these dyes.

In the light of the above, it seems difficult to support Russel's contention<sup>2</sup> that extremely fast plates have to be used to obtain perceptible effect without unduly long exposures. The activity can best be studied by using the so-called non-colour-sensitised plates or emulsions, viz., plates or emulsions, sensitive only to the blue and shorter wave-lengths.

It is found that the interposition of a very thin sheet of mica or glass stops the effect completely. From this Russel draws the conclusion that the observed action is not a case of radio-activity. It is a well-known fact that radio-active emanations affect all types of plates and the absence of any perceptible effect on orthochromatic and panchromatic emulsions is additional evidence that Russel effect is not due to radio-activity.

The action is found to be exerted through filter-paper, and even ordinary paper, and also when the plate is separated by a short distance from the surface of the wood specimen. From these, it seems safe to conclude that the oxidising substances responsible for the activity are in the form of gases or vapours.

The author is grateful to the authorities of the Pachaiyappa's College for facilities afforded him to carry out this investigation.

Dept. of Physics, V. P. NARAYANAN NAMBIYAR.  
Pachaiyappa's College,  
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### STELLATE TWINNING IN CORDIERITE\*

SIMPLE, polysynthetic (or lamellar), and sector twinning in cordierite are of common occurrence and descriptions are not lacking in literature. Some reference to stellate forms of twinned cordierite<sup>1</sup> are also found, but it is not quite definite whether it is used synonymously with sector twinning (yielding trillings and six-lings) or not, as no detailed descriptions or figures are given.

This is to place on record the occurrence of a twinned cordierite which has the form of a

twelve-pointed star noticeable in basal sections under crossed nicols. Similar twins do not appear to have been described or figured so far. Dittler and Kohler<sup>2</sup> have, however, described an allied form of a twin of synthetic cordierite with twelve sectors built by twelve radiating and alternating (110) and (130) twin planes extending to the periphery.

While examining some specimens of para-lavas collected by Sir Lewis Fermor from the Bokaro coalfield in 1916, a specimen (23/952) described as a "sillimanite-cordierite-labradorite vitrophyre" was noticed to contain some cordierite crystals showing very beautiful stellate twins. Fermor<sup>3</sup> has previously recorded cordierite crystals showing normal interpenetration twins from these rocks. The rock is seen to consist of pseudo-hexagonal crystals of cordierite, rosettes of labradorite laths, rhombic pyroxene and some magnetite embedded in a dark to light brownish grey glassy ground-mass showing signs of devitrification. It is believed that these para-lavas have been produced by the fusion and recrystallisation of the sedimentary strata associated with the coal seams when the latter caught fire and burned.

The cordierite crystals in this rock vary in size from 0.05 mm. to 1.0 mm. and the larger crystals show numerous branching outgrowths towards the periphery (described as hexagons with tentacles or multiple terminations<sup>4</sup>) which is seldom bounded by straight and plane surfaces. The grains of cordierite show-

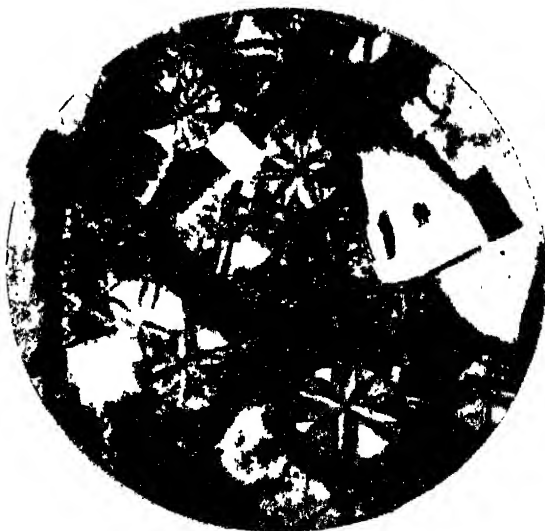


FIG. 1. Star-shaped twins of cordierite in para-lava. Crossed nicols,  $\times 48$ .

\* Published with the permission of the Director, Geological Survey of India.

ing the stellate twins occur as smaller grains measuring 0.13 mm. to 0.3 mm. Such twins are also commonly seen in the cores of the larger irregular crystals. Fig. 1 shows some of the stellate twins of cordierite in the rock as seen in a microsection under crossed nicols.

The twins are formed by a set of 12 radiating twin planes spaced at  $30^\circ$  to one another (Fig. 2). About halfway towards the periphery

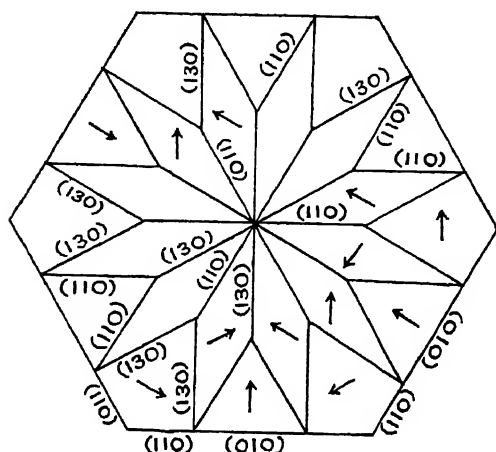


FIG. 2. Detailed diagrammatic representation of a stellate twin.

each of these twelve twin planes bifurcate making angles of  $30^\circ$  with the original course and these secondary twin planes meet at the periphery building a twelve-pointed star-shaped pattern. It is interesting to note that both (110) and (130) twin planes are present and the alternating ones in the central portion are similar. It will be seen that when two like twin planes meet, the angles are  $60^\circ$  or  $120^\circ$  (or multiples of  $60^\circ$ ) but when unlike planes meet, the angles produced are  $30^\circ$  or  $90^\circ$  (or odd multiples of  $30^\circ$ ).

The vibration direction of the slow ray or Z, which coincides with the *b* crystal axis in cordierite, is shown as arrows in Fig. 2. The vibration directions Z and Y have been the means of identifying the twin planes as well as the crystal faces forming the bounding planes of the pseudo-hexagonal prism in the twinned grain. A different arrangement with the (130) planes in the place of the (110) planes and *vice versa* producing an identical pattern is also possible but the bounding planes will become (100) and (130) instead of (010) and (110). Such cases, however, have not been found among the twinned grains studied.

The cordierite twins examined are not exactly identical with the perfectly geometric pattern shown in Fig. 2 as some portions are ill-developed and the external hexagonal boundary is seldom well defined; but the general angular relations and pattern is essentially the same. A different pattern of twinning is often seen in cordierites which have grown to larger sizes around a central core of a stellate twin. Apart from these striking stellate twins a few other patterns are also met with in twinned cordierites.<sup>5</sup> A detailed study of twinning in cordierite from rocks of different Indian localities is expected to be published soon.

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### SOME N<sup>1</sup>-N<sup>3</sup>-DISUBSTITUTED GUANIDINES

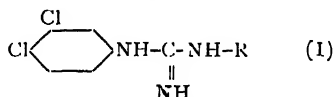
DURING the progress of research on chemotherapeutically active substances, King and Tonkin<sup>1</sup> discovered that *p*-tolyl-guanidine nitrate had a slight retarding action on a sporozoite-induced infection of *Plasmodium gallinaceum* in chicks. A large number of aromatic and aliphatic guanidines were then synthesized by the same authors, the most active among them being *p*-anisyl-guanidine nitrate.

The discovery of *Paludrine* by Curd and Rose<sup>2</sup> led them to synthesize a large number of substituted diguanides related to *Paludrine*, but carrying various mono- and poly-halogeno-phenyl groups in place of *p*-chloro-phenyl.<sup>3</sup> It was noted that the 3:4-dihalogeno-derivatives were the most effective and especially the 3:4-dichloro-compounds showed markedly higher suppressive activity (roughly 5-10 times) on malarial infections than the corresponding members of the *p*-halogeno-series.

It was, therefore, thought worthwhile to prepare guanidine derivatives of the type (I) carrying 3:4-dichlorophenyl group at N<sup>1</sup>-position and having alkyl-, aryl-, or sulpha-substituted residues at N<sup>3</sup>-, and to study their pharmacological properties. Accordingly, 3:4-dichlorophenyl cyanamide (m.p.  $134^\circ\text{C}$ .) was prepared

by a modification of Pierron method,<sup>4</sup> and reacted with some aromatic and aliphatic amines, as well as some sulphoamides in pyridine medium and the following 12 compounds have been isolated and characterised.

TABLE



Sl. No.	R	m. p. °C. (uncorrected)
1	Phenyl	135-136
2	<i>p</i> -Chlorophenyl	161-162
3	<i>p</i> -Bromophenyl	175-176
4	<i>p</i> -Iodophenyl	173-174
5	<i>p</i> -Tolyl	150-151
6	<i>p</i> -Anisyl	107-108
7	3:4-Dichloro-phenyl	173-175
8	3:4:5-Trichloro-phenyl	168-169
9	Methyl	153-155
10	2-Butyl	92- 94
11	Sulphanilylguanidyl	113-115
12	Sulphanilyl (hydrochloride)	185-186

All the compounds were crystallised in the form of small, shiny, white needles or long plates from water or dilute ethanol. These compounds are awaiting pharmacological investigations.

Further work on substituted guanidines is in progress. Full details of the present work will be published elsewhere.

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### THE MECHANISM OF THE CONDENSATION OF ETHYL ACETO- ACETATE WITH RESORCINOLS

AHMED AND DESAI<sup>1</sup> had suggested that, in the condensation of ethyl acetoacetate with resorcinols, in the presence of acid catalyst, the reactive hydrogen, which is in the ortho position to the hydroxyl group, co-ordinates with the carboxyl oxygen of the acetoacetate and the addition product then undergoes dehydration and cyclisation. However, in the acidic medium, most of the acetoacetic ester should be expect-

ed to be present as enol and the reasons why sulphuric acid should give 7-hydroxy coumarins and anhydrous aluminium chloride should give 5-hydroxy coumarins,<sup>2</sup> when there is an electron attracting group in the 4 (or 6) position (I) in the resorcinol nucleus, are not given.

The suggestion of Robertson and co-workers<sup>3</sup> that substituted cinnamic acid is formed as an intermediate has experimental support and so looks more plausible, but the mechanism of its formation was not suggested.

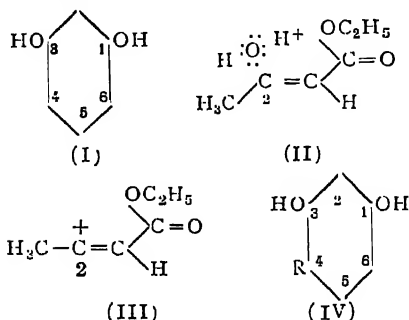
Shah and co-workers<sup>3a</sup> explained the formation of 5-hydroxy coumarin, when resorcinol substituted with electron-attracting group in the 4 (or 6) position is condensed with ethyl acetoacetate in the presence of anhydrous aluminium chloride, on the basis of the assumption that the chelation between the hydroxyl hydrogen and the oxygen of the substituent group requires the fixation of the double bond in the benzene nucleus between the carbon atoms bearing these two groups and the substitution occurs at the carbon atom joined by the double bond, to the carbon atom linked to the hydroxyl group.<sup>4</sup> However, on the basis of this view, the role of the catalyst in the condensation, and the reasons why other catalysts, such as sulphuric acid, give different results, are not explained. The validity of the view of complete fixation of the double bonds has also been considered to be doubtful.<sup>5,6,7</sup>

When a compound containing unshared electrons is treated with an electrophilic reagent, it is considered that the carbonium ion may be set free as a transitory reaction intermediate or may be transferred to a new linkage without actually being liberated, depending on the experimental conditions of the reaction; the driving force in either case being the affinity of the electrophilic reagent for the unshared electrons.

A double bond at the seat of substitution should inhibit the bond fission between HO and C<sub>2</sub> carbon atom (II) of acetoacetate ester (cf.<sup>8</sup>), due to the induced electromeric dis-

placement   
on the other hand the electrophilic reagent would tend to pull the electrons away from the C<sub>2</sub> carbon atom and thus tend to break the bond between OH and C<sub>2</sub> carbon atom. It is suggested that when the condensing agent is an electrophilic reagent such as a proton (derived from sulphuric acid, for example, which has loosely bound protons, (II) may be obtained but when a stronger

electrophilic reagent such as anhydrous aluminium chloride is used the carbonium ion (III) may be formed, from acetoacetic ester. Then the carbon atom  $C_2$  being electrophilic, would seek the ring carbon atom with greatest electron density in the resorcinol nucleus.



When an electron repelling group such as OH group is attached to the ring carbon atom of the benzene nucleus, the ring on the whole is activated due to resonance, the *ortho* and *para* acquiring a greater electron density, and among the two, the *para* substitution is mostly favoured.<sup>9</sup> Hence (II) or (III) should attack the carbon atom at 4 (or 6) position in the resorcinol (I) resulting in the formation of substituted cinnamic acid as the intermediate, which on ring closure with elimination of alcohol molecule, would give 7-hydroxy coumarin. This would be in agreement with the experimental evidence that the condensation of acetoacetic ester and resorcinol gives 7-hydroxy coumarin irrespective of the nature of the condensing agent.<sup>2</sup>

When an electron-attracting group such as nitro or carboxy group is attached to the ring carbon atom of the benzene nucleus, the ring on the whole is deactivated, the deactivation effect being more for the *ortho* and *para* positions.<sup>9</sup> It has also been mentioned<sup>2</sup> that an electron-attracting group attached to 2-carbon atom (I) has a lesser deactivation effect than when an electron-attracting group is attached to carbon atom at 4 position (or 6). It, therefore, follows that when an electron-attracting group is attached to carbon atom at 4 position, the deactivation should be more at 6-position than at 2-position. Hence, the attack of the entity III (when anhydrous aluminium chloride is the condensing agent), should be predominantly on the carbon atom at 2-position. This would give 5-hydroxy coumarins. But when the attacking entity is (II) or similar (when the condensing agent is an electrophilic reagent such as the proton derived from sulphu-

ric acid) the consideration of the geometry of II and IV would indicate that the attack on carbon atom at 2-position would be inhibited) due to steric requirements and hence the attack would be predominantly on the carbon atom at 6-position, which would give 7-hydroxy coumarin, in agreement with the experimental evidence.<sup>2</sup>

The authors wish to thank Dr. R. C. Shah for helpful comments.

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#### CO-PRECIPITATION OF COBALT WITH CHROMIUM HYDROXIDE

It has been observed by the author that during the qualitative analysis of cobalt chromate most of the cobalt in solution and quite often all of it is precipitated together with chromium in the third group when ammonia is employed as the reagent for separation. Cobalt has been observed to co-precipitate with  $Al(OH)_3$  by Blum<sup>1</sup> and its co-precipitation with  $Fe(OH)_3$  has been studied thoroughly by Kolthoff and co-workers.<sup>2,3</sup> There is no mention in literature about its co-precipitation with  $Cr(OH)_3$ . Perhaps the only reference to entrainment by  $Cr(OH)_3$  is that of Noyes, Bray and Spear<sup>4</sup> who have mentioned that Zn and Mn can be carried down by  $Cr(OH)_3$  in qualitative analysis. A quantitative study of the co-precipitation of cobalt has, therefore, been undertaken.

The co-precipitation of Co in presence of varying amounts of  $NH_4Cl$  has been determined by the method of Kolthoff and Overholser.<sup>2</sup> 20 c.c. of M/20  $Cr_2(SO_4)_3$  were mixed with 20 c.c. of M/10  $CoSO_4$  in a 100 c.c. volumetric flask and the appropriate amount of  $NH_4Cl$  added. The requisite amount of standard carbonate-free ammonia was then added and the

mixture made up to the mark with CO<sub>2</sub>-free water and well shaken. It was filtered after allowing to stand for 5 minutes and the cobalt in the filtrate estimated using oxine. Table I gives the effect of varying the strength of NH<sub>4</sub>Cl on the co-precipitation of cobalt for an equilibrium ammonia concentration of 1N.

TABLE I

Strength of NH <sub>4</sub> Cl	0.5 N	1.0 N	1.5 N	2 N
% Co-precipitation of Co	96.60	90.2	86.50	75.60

The Table shows that the extent of co-precipitation is extremely high even in 2N NH<sub>4</sub>Cl. Working with Fe(OH)<sub>3</sub>, Kolthoff and Overholser noticed co-precipitation of only cobalt to the extent of 12.3 per cent. under similar conditions (concentration of NH<sub>3</sub> = 0.9 N.). The co-precipitation of cobalt is found to increase with decrease in the strength of ammonia.

It is clear, therefore, that the method of separation of Fe, Al and Cr from Ni, Co, Zn and Mn in qualitative analysis by the use of a slight excess of ammonium hydroxide in presence of ammonium chloride is extremely unsatisfactory.

A detailed account of this investigation will be published elsewhere.

The author's thanks are due to Dr. S. K. Bhattacharyya, for his kind interest in the work.

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#### AN ANATOMICAL PECULIARITY IN RICE (*ORYZA SATIVA*)

In our attempt to classify the various rice varieties on the basis of bran layer thickness, an anatomical peculiarity, not previously reported by any worker, has been observed.

Dehusked grains were soaked in water for 19 hours, after which transverse sections by hand were cut with a razor. The sections were stained in 1% eosine and mounted in glycerine. Thirteen glutinous and ten non-glutinous

rices were used. For each variety, twelve grains, two sections from each grain and two random readings in each section were taken.

In addition to the normal aleurone layer as is found in every rice grain, in some of the grains of the above varieties there occurs a conglomeration of thickened cells towards the dorsal side in the spermoderm region. Such a patch is not seen in the ventral side (embryo side) of the grain.

No correlation could be found between the existence or size of the patch of cells and the nature of the rice grain, its colour or its quality. The patch was not invariably found in all cases, e.g., three varieties (T.56, T.90 and T.1145) do not manifest any such structure. The patch of cells respond positively to the Xanthoproteic reaction (Miller<sup>1</sup>) and the test for protein suggested by Johansen.<sup>2</sup>

Ramiah and Mudaliar,<sup>3</sup> while studying the process of protein formation in the rice grain, had observed that on the third day after anthesis the innermost layers of the ovarian wall contain the maximum amount of protein. On the fourth and fifth day after anthesis, as the development of the endosperm progresses, the protein starts passing towards the endosperm. On the sixth day after anthesis, the protein seems getting exhausted from the ovarian wall and it moves on to the aleurone layer (which almost starts differentiating) and the adjoining one or two layers of endosperm cells. On the basis of these observations, the following hypothesis regarding the formation of the patch seems plausible. While the protein passes from the ovarian wall to the peripheral endosperm, it may have been partially prevented from moving into the aleurone layer at the particular spot. How this happens needs investigation. The growth and development have to be followed right from fertilization to seed formation.

I am thankful to Sri. K. Ramiah for his constant encouragement during the investigation and gratefully acknowledge the technical assistance of Sri. R. Seetharaman.

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### BLOOD GROUP CHARACTERISTICS IN SOUTH INDIANS

THE donors coming to the Blood Bank Section, Stanley Hospital, Madras, formed the material for the present investigation.

**A<sub>1</sub>A<sub>2</sub>BO Groups.**—The ABO groups were determined first using high titre Group A and Group B sera by means of the tile technique. The persons belonging to Groups A and AB were sub-grouped using absorbed Group B serum. Paraffin ring slides were used for these tests. 394 South Indians were tested. The distribution of the A<sub>1</sub>A<sub>2</sub>BO Groups is shown in Table I.

TABLE I

Group	No. of persons	Percentage
A <sub>1</sub>	74	18.78
A <sub>2</sub>	14	3.55
B	112	28.43
A <sub>1</sub> B	21	5.33
A <sub>2</sub> B	6	1.52
O	167	42.39
Total	394	100.00

The gene frequencies were as follows:  
 $p_1 = 0.1266$ ;  $p_2 = 0.0268$ ;  $q = 0.1904$ ;  
 $r = 0.6510$ .

**M-N Types.**—60 people were grouped using anti-M and anti-N sera. The distribution of the various types is shown in Table II.

TABLE II

Group	No. of persons	Percentage
M	30	50
MN	23	38.33
N	7	11.67
Total	60	100.00

The gene frequencies were as follows:  
 gene M = 69.2; gene N = 30.8.

**Rh Factor.**—132 random individuals were tested using anti-D serum containing saline agglutinins, by Landsteiner's tube method.<sup>1</sup> 96.2 per cent. were Rh positive and 3.8 per cent. were Rh negative.

**Secretor Factor.**—Saliva samples of 200 individuals belonging to Groups A, B and AB were tested for the secretion of the group-specific substances using the qualitative inhibition technique of Wiener.<sup>1</sup> 70.5 per cent. were secretors and 29.5 per cent. were non-secretors.

**Iso-haemagglutinin** titres of 100 individuals of Group A, 100 individuals of Group B and 100 individuals of Group O were determined using

the technique of Brewer.<sup>2</sup> 14 per cent. of individuals of Group A, 29 per cent. of individuals of Group B and 16 per cent. of individuals of Group O have a titre above 320. 9 per cent. of Group O individuals have a titre of 640 or above. These should be considered as Dangerous Universal Donors. It is usually said<sup>3</sup> that the anti-A titre is greater than the anti-B titre in Group O. While this is true for 51 out of 100 individuals of Group O tested, it is found that in 31 per cent. the anti-B titre is as high as anti-A and in 18 per cent. the anti-B titre is actually higher than anti-A. This shows, in South Indians, the necessity for testing both anti-A and anti-B titres to eliminate a dangerous universal donor.

Grateful thanks are due to Dr. Mourant, Blood Group Reference Laboratory, London, for kindly supplying absorbed Group B, anti-M and anti-N sera, to the Director, King Institute, Guindy, for the supply of high titre Group A and Group B sera, and to Drs. Venkatramiah and Vared for their guidance and help.

Dept. of Physiology. A. KRISHNA RAO.  
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### VANADAMETRIC ESTIMATION OF TARTARIC ACID

It has been considered interesting to try the use of sodium vanadate for the oxidimetric estimation of tartaric acid in view of the unsatisfactory character of the existing methods. In recent years Gopala Rao and co-workers<sup>1</sup> reported on the use of sodium vanadate for many estimations, while Syrakomskii,<sup>2</sup> *et. al.*, reported on the use of ammonium vanadate. In the method developed by the present authors, about 5 ml. of tartaric acid solution (containing about 7.5 g. of the acid per litre) is heated for fifteen minutes on a water-bath along with 5.0 ml. of a normal solution of sodium vanadate and 5.0 to 15.0 ml. of concentrated sulphuric acid. The mixture is cooled, diluted to 100 ml. and then titrated with a standard solution of ferrous sulphate to determine the unreacted vanadate. Results show that the reaction between vanadic acid and tartaric acid proceeds quantitatively according to the equation





Variation of the amount of sulphuric acid from 5 ml. to 15 ml. with heating for fifteen minutes has no material influence on the course of the reaction.

Vanadic acid (unlike potassium permanganate and potassium iodate) does not show any sign of decomposition on heating with concentrated sulphuric acid even for 2 hours. In one experiment 5.0 ml. of normal vanadate solution were heated with 15.0 ml. of concentrated sulphuric acid for two hours. The results obtained showed excellent agreement between the values of tartaric acid as determined by the vanadate and dichromate methods. The tartaric acid employed in this investigation is the Analar quality of British Drug Houses Ltd., London. The assay values agree very well with the values taken by weight.

Under the conditions of our experiments, oxalic acid is also completely oxidized by vanadic acid to carbon dioxide and water. This rules out the possibility of estimating tartaric acid in the presence of oxalic acid. We also made experiments on the oxidation of tartaric and oxalic acids by vanadic acid in dilute aqueous solution in the cold. Both the organic acids react with vanadic acid in the cold, although slowly. Hydrochloric acid should not be used in place of sulphuric acid in all the above experiments, as it has been found that vanadic acid interacts with hydrochloric acid in the cold when the concentration of the latter exceeds 4 N; even at lesser concentrations in the hot. Full details of the work will be published elsewhere.

Dept. of Chemistry, G. GOPALA RAO.  
Andhra University, H. SANKEGOWDA.  
February 29, 1952.

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### VANADAMETRIC ESTIMATION OF INDIGO AND INDIGO CARMINE

THE common method for the volumetric estimation of indigo is through oxidation by potassium permanganate to isatin. Heinsch<sup>1</sup> claimed that this is the best technical method available for the determination of indigotin. It must, however, be noticed that the method

suffers from a serious drawback, namely, that the reaction is not stoichiometric and requires the use of empirical reaction conditions and empirical correction factors.<sup>2</sup> Moreover, the method cannot be employed in the presence of organic matter like starch, dextrin or gum with which commercial samples of indigo are usually adulterated since they also react with the permanganate.

Our experiments show that sodium vanadate possesses advantages over potassium permanganate for the estimation of indigo while it is free from its defects. In view of the slow reaction between indigo sulphonate and vanadate, estimation by direct titration has not been found possible. The method, therefore, consists in mixing an aliquot of indigo sulphonate solution with a known excess of standard vanadate solution in acid medium and keeping till the reaction is completed as indicated by the disappearance of the blue colour; the unreacted vanadate is determined by titration with a standard solution of ferrous sulphate, after addition of phosphoric acid and diphenyl benzidine indicator. Our experiments carried out under widely varying concentrations show that the reaction is stoichiometric, two gram moles of vanadate are required for every gram mole of indigo sulphonate. The results yielded by our vanadametric method have been checked up with weighed quantities of chemically pure indigo as also with the permanganometric method using the empirical correction factor. Our results agree to within 0.5 per cent. It has also been observed that the reaction between indigo sulphonate and vanadate can be accelerated by the addition of a small quantity of oxalic acid (1 ml. of 1.0 N.) without introducing any error in the determinations.

Estimations of indigo sulphonate carried out with the vanadate method in the presence of starch, dextrin and gum have shown that these substances do not interfere whereas estimation with permanganate have yielded higher values due to the oxidation of these substances.

Chemical Laboratories, G. GOPALA RAO.  
Andhra University, M. NARASIMHA SASTRI.  
Waltair,  
March 4, 1952.

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### T.A.N. CHANGES IN THE LEAVES OF *TAMARINDUS INDICA* LINN.

THE cell sap of plants belonging to Crassulaceae and of a few other succulent plants with high concentrations of organic acids is known to exhibit diurnal fluctuation in acidity—the acidity being highest in the morning and lowest in the evening. This phenomenon was first designated as Crassulacean metabolism by Bennet-Clark.<sup>1</sup> In his review Bennet-Clark included a few non-succulent plants also which show a Crassulacean type of metabolism, and expressed the view that all those non-succulent plants which show high enough concentrations of organic acid, possess this type of metabolism.

*Tamarindus indica* Linn. is a non-succulent plant of the tropics with a relatively high concentration of organic acids, the pH of the leaf sap varying from 3.1 to 3.5. The plant, therefore, falls in the acid group of plants in Small's scheme of classification.<sup>2</sup> The present study has been taken up with a view to see whether Bennet-Clark's generalisation quoted above applies to a tropical plant like *Tamarindus*.

The pH shows a decrease with increasing age of the leaf until in the oldest leaves again it increases with age. The titratable acidity of the leaf sap is expressed in terms of the Titratable Acid Number (T.A.N.) (Thomas).<sup>3</sup> However, in the present work it is the amount in c.c. of 1/50 N. NaOH required to neutralise 1 g. of leaf tissue. The T.A.N. is lowest in the youngest leaves, increases with age and falls again in the oldest leaves. The T.A.N. of leaves of different age groups has been determined at various hours during the day and night at regular intervals. Within each age group there is little diurnal fluctuation in T.A.N., the difference between the lowest and highest values in a day never exceeding 6%. On the other hand, in plants with Crassulacean metabolism the percentage changes in acid content were usually very high, reaching as high a value as 1,280 in some.<sup>1</sup> Diurnal fluctuation could not be observed also in *Geranium pratense*.<sup>3</sup> *Mesembryanthemum edule*,<sup>4</sup> a species of *Sedum*<sup>4</sup> and *Fagopyrum*.<sup>5</sup>

The T.A.N. is found to be highest in the winter months of December, January and February when the lowest temperatures of the year obtain at Waltair. *Tamarindus indica* thus does not exhibit the diurnal fluctuations observed by Bennet Clark and others in plants showing Crassulacean metabolism although it

retains some of the features of those plants, namely, increasing titratable acidity and decreasing pH with age and seasonal fluctuation in acidity.

Further details and discussion will appear elsewhere.

Our thanks are due to Prof. G. N. Ranga-swami Ayyangar and Prof. J. Venkateswarlu for their kind encouragement.

Dept. of Botany, D. V. V. SESHAGIRI.  
Andhra University, R. L. N. SASTRI.  
Waltair,  
May 23, 1952.

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### ON THE ROLE OF TAMARIND AND CHILLI IN THE RICE DIET

TAMARIND and dried chilli in proportions usually added to the rice diet<sup>1</sup> have been shown<sup>2,3</sup> to improve the growth rate of experimental animals. Since these supplements do not appreciably contribute to the protein, fat, carbohydrate, mineral or vitamin content of the diet, the beneficial effect was attributed to some unknown factor or factors associated with them.

In actual practice, the incorporation of tamarind and chilli in different food preparations is invariably accompanied by addition of extra quantity of salt. In their preparatory trials, Krishnamurti, *et al.*,<sup>3</sup> found that to get the correct taste, salt had to be incorporated to the extent of 25 per cent. of the total solids of the soup. It appeared probable that this extra quantity of salt may have some bearing on the improved growth response as observed.

Two groups of weanling rats selected out of littermates were fed as follows: (1) on poor rice diet (98.75 per cent.) plus 1.25 per cent. of usual bazaar common salt, and (2) poor rice diet (95 per cent.) plus tamarind-chilli-salt soup corresponding to 2.5 per cent. of the diet as tamarind, 1.25 per cent. as chilli and 1.25 per cent. as salt. The rice diet used was similar to the one used by Krishnamurti, *et al.*,<sup>3</sup> but without the salt. With a view to overcoming discrepancies arising out of differences in food intake, a third group of comparable rats were fed on diet (2), adopting the paired feeding technique.<sup>4</sup> The average total gains in

weight (in g.) over a period of six weeks were: rice diet with added salt  $31.8 \pm 1.94$ ; rice diet with added tamarind, chilli and salt (*ad lib.*)  $31.5 \pm 1.31$ ; rice diet plus tamarind, chilli and salt (pair fed)  $31.8 \pm 2.10$ . From this it would appear that the enhanced growth rate reported earlier was not due to any growth-promoting factors in tamarind or chilli and could probably be attributed to the extra salt contributed by the soup. The above finding has been further confirmed by studying the effect of 1 per cent. common salt as supplement to the rice diet.<sup>1</sup> Over a period of eight weeks, the average weekly growth rate of rats was: Rice diet  $3.9 \pm 0.2$ ; Rice diet plus 1 per cent. common salt  $5.1 \pm 0.1$ ; these values are significantly different and the difference is of the same order as reported earlier.<sup>3</sup>

Since the percentage of crude salt in the poor South Indian diet<sup>1</sup> as recommended by the Vanaspati Research Planning Committee is much lower than that ordinarily consumed in South India,<sup>2</sup> it was of interest to find out whether this difference in growth is due to an increased intake of sodium chloride alone or the mineral impurities present in crude common salt. Hence the above animal experiment was repeated using 1 per cent. of pure sodium chloride (A. R.) instead of crude common salt. The weekly gains in weight for a period of eight weeks were: Rice diet  $3.4 \pm 0.28$ ; Rice diet supplemented with 1 per cent. sodium chloride (A. R.)  $4.0 \pm 0.24$ . The difference is not statistically significant.

In the experiments with crude salt the same specimen of bazaar salt was used. It contained 0.60 per cent. calcium. It has been already reported<sup>5</sup> that the calcium present in crude salt is available to the human system.

From the above results it would appear that the growth-promoting effect of tamarind-chilli soup is due to crude common salt usually used for the preparation and not to tamarind and chilli. The beneficial effects of the crude salt are presumably traceable to the calcium and other mineral impurities present in it.

The crude common salt as used in most Indian homes, at any rate, in South India, is prepared out of sea-water which is known to contain small quantities of several mineral impurities in addition to calcium. The salt is admittedly variable in composition and its keeping quality varies with the impurities and particularly with the calcium and magnesium salts. If the nutritive value of the diet is influenced by the impurities, there would be need

to re-orient the method of preparation of salt so as to preserve the desirable constituents without impairing the keeping quality.

Central Food Tech. N. SUBRAMANIAN.  
Research Institute, B. K. SUR.  
Mysore, V. SUBRAHMANYAN.  
May 21, 1952.

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### "EARLESS", A NEW MENDELIAN CHARACTER IN RAGI (ELEUSINE CORACANA GAERTN.)

MORPHOLOGICAL abnormalities that behave as Mendelian characters have not been reported in Ragi (*Eleusine coracana*, Gaertn.) so far. One plant with small leafy shoots instead of the normal earheads was observed in an yield trial plot during the main season of 1951. These leafy structures developed on rachis corresponding to the spikes in a normal plant. These structures when transplanted on to pots struck root showing that the plants can be propagated vegetatively. It needs no mention that such mutations are rare in nature.

The same abnormality was also observed in the summer crop of ragi in 1952, in a large collection of ragi samples under study. The progenies of one single plant selection M.S. 6450/3 were observed to segregate for normal looking plants and those with leafy shoots in place of earheads in a regular Mendelian ratio.

It was observed that in a total population of 391 plants, there were 294 normal looking, while 97 had leafy shoots in place of earheads, showing that the counts are very close to the theoretical 3:1 ratio. The planting was done in 3 randomised plots in the field and the data obtained is given below:

		Normal		Earless
Replication	1	..	90	34
..	2	..	108	35
..	3	..	96	28
Total		..	294	97
Expected (3:1)		..	294	98

In a similar observation recorded by Sampath and Krishnaswamy,<sup>1</sup> mutation in rice behaving as a Mendelian recessive was found to be due to deficiency of two chromosomes.

Agricultural Res. Inst., K. DIWAKARAN.  
Lawley Road Post, P. KRISHNA RAO.  
Coimbatore, V. KRISHNASWAMY.  
May 8, 1952.

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### ISOLATION OF SAPONIN FROM THE SEEDS OF *ALBIZZIA LEBBECK* (N.O. LEGUMINOSAE)

EXTRACTION of the seeds of *Alibizzia lebbeck* (N.O. Leguminosae) with carbon tetrachloride gave no oil, but on working up the alcoholic extract, a white solid was obtained. Tests for alkaloids were negative. A preliminary investigation showed that the active principle obtained was probably a saponin. A number of experiments were tried to get it in pure condition. A small quantity thus obtained showed a high hæmolytic activity on red blood corpuscles and responded to all the diagnostic tests for a saponin. Further work is in progress.

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Ahmedabad.  
May 5, 1952.

### ACCESSORY BUDS IN SUGARCANE

RAGHAVAN<sup>2</sup> reported to have noticed multiple buds in sugarcane. This is not a new phenomenon in this grass. Such occurrences were reported and commented as far back as 1933 by Khanna.<sup>1</sup> Very recently as many as 5 buds were noticed in a Pusa hybrid, X 4668, a whorl of buds was observed in Hadda, an indigenous cane, and a Co. 453 developed 3-4 buds at one node.

Raghavan<sup>2</sup> further reported that only one of the multiple buds germinated while it is found that in most of the cases at Pusa all the accessory buds germinate, though the shoots arising out of them are not as healthy as those from normal setts.

The suggestion by Raghavan that micro-elements or hormones lead to the formation of multiple buds (more appropriately accessory buds) appears to be untenable. The availability of minor elements and their effects on the growing crops depend upon the pH of the soil which has been worked out in detail among

others by Truog.<sup>3</sup> In a particular soil type, the effect of any one of the micro-elements and that too on a particular node of a crop variety is obviously ruled out. Likewise the causal agent being hormones cannot also be accepted as their specific formation in plants in the same environment is not possible. However, there is full agreement with the observations of the author that this phenomenon has no genetic significance, as has already been pointed out by Khanna.<sup>1</sup>

The occurrence of multiple buds at a node may be taken as an anomalous structure in a cane-stalk. The interpretation of such conditions is best made on the basis of ontogenetic studies. In Angiosperms it is the rule that each leaf has a bud in its axil. The additional buds found in the same axil (as in the observation) are accessory buds. It is not necessary that all such buds must develop into shoots. Their development depends on the competition among themselves for light and nutrition. Instances are on record where more than one bud develops into shoot.

The terminal buds are very active in any plant and the lateral buds decrease in vigour and activity the further they are from the terminal bud. This is a very prominent feature in sugarcane. Lateral buds normally arise by the development of new apical meristems laterally in the terminal meristems of the mother shoot. Such meristems arise by the division of meristematic cells, or sometimes of more or less permanent parenchyma, in several planes, and form an apical growing point like that of the stem tip. Cortical and epidermal layers of cells along the sides of mother shoots are involved in the formation of such buds which thus have superficial origin from the apical meristem of the parent stalk. In the light of this background the phenomenon of apical dominance, which is very pronounced in Angiosperms may explain the possibility of multiple buds at a node in a cane-stalk. The dominant apical bud of sugarcane prevents the formation of shoots from buds further down the stalk. Likewise the growth of basal roots prevents the growth of roots further up the stem, even though the root primordia are present. If through any agency (most probably external) the apical dominance is reduced, thus arresting the development of the apical bud for some time, the primary meristematic cells are likely to protrude out at more than one place. Hence the formation of more than one bud in the axil of a leaf. When this external factor is removed

and the apical bud resumes its normal growth resulting in the elongation of cane-stalk, no such occurrences are found on other nodes. This explains why multiple buds are found only on a few nodes and not on every node on a stalk.

My thanks are due to Sri. K. L. Khanna for his active interest in the work.

Central Sugarcane Res. Station, C. THAKUR.

Pusa,

February 11, 1952.

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### ASSAY OF VITAMIN A AND CAROTENE IN BLOOD SERUM

BESSEY, *et al.*,<sup>1</sup> adopted the irradiation technique and used kerosene-xylene mixture (1:1) as solvent for the extraction and estimation of vitamin A in blood serum. It has been observed that kerosene and xylene contain organic impurities which show a characteristic absorption that changes with ultra-violet irradiation. It was found, however, that when the solvents were refluxed over metallic sodium for several hours and then distilled there was no change in absorption after ultra-violet irradiation. Xylene distilled at  $138.5^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$ . and kerosene distilled between  $180^{\circ}\text{C}$ .- $195^{\circ}\text{C}$ . were collected and used in the present investigation (their respective densities were 0.8620 and 0.7736 at  $27^{\circ}\text{C}$ .).

For destroying vitamin A, Little<sup>2</sup> recommended that the range of the irradiating light should be between  $310\text{ m}\mu$  and  $400\text{ m}\mu$ . Bessey, *et al.*, used a General Electric B-H4 mercury discharge lamp with a purple envelope; the envelope cuts off radiation above  $400\text{ m}\mu$  and the soft glass tubes used for irradiating the solution cut off radiation below  $310\text{ m}\mu$ . In our experiment a Hanovia mercury vapour lamp (450 W) and a Woods glass were used. This filter absorbs radiation completely below  $300\text{ m}\mu$  and above  $400\text{ m}\mu$  with a maximum transmission (about 34%) at  $365\text{ m}\mu$ . When vitamin A in kerosene-xylene mixture (1:1) is irradiated in a Pyrex test-tube of 1 cm. internal diameter by this arrangement, the residual absorption gradually decreases with the period of irradiation and comes to about 6.9 per cent. at the region of maximum absorption after an hour's exposure. This has been found after repeated trials to be

nearly constant under our experimental conditions. The change in the absorption curve of vitamin A palmitate is shown in Fig. 1. Vita-

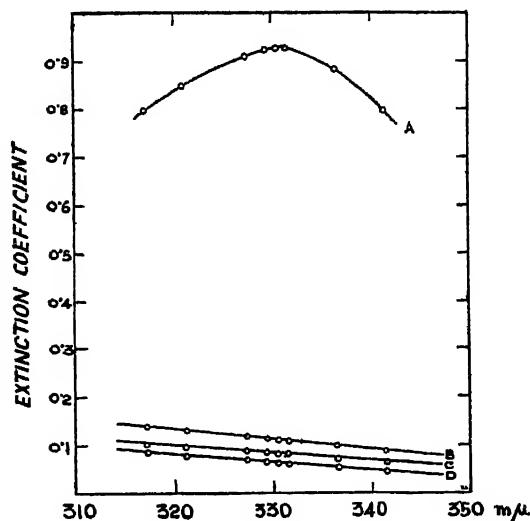


FIG. 1

Absorption curves of vitamin A palmitate in kerosene-xylene mixture (1:1) before and after ultraviolet irradiation.

min A solution was taken in Pyrex test-tube of 1 cm. internal diameter and irradiated by Hanovia mercury vapour lamp (450 W) with Woods glass from a distance of 8 cm. The lamp was turned on for 20 minutes before irradiation.

A—Before irradiation.

B—Irradiated for 30 minutes.

C—Irradiated for 45 minutes.

D—Irradiated for 60 minutes.

With the modifications mentioned above it was found that vitamin A and carotene estimations in blood serum could be carried out satisfactorily.

The Beckman spectrophotometer used in this work is the gift of the Watumull Foundation to the Government of India. Our thanks are due to them for the use of the instrument.

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All-India Inst. of Hyg. & Pub. Health,  
Calcutta,  
April 15, 1952.

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# ROTATORY DISPERSION OF BARIUM SALT OF REYCHLER'S ACID

In an earlier paper<sup>1</sup> the rotatory dispersion of magnesium salt of Reyckler's acid<sup>2</sup> was reported. In this note the rotatory dispersion of barium salt of D-camphor 10-sulphonic acid is described.

The barium salt was prepared essentially according to the method described by Graham.<sup>3</sup> It was repeatedly recrystallised from water. It was kept at 130° in an air-oven for ten hours when the completely anhydrous salt was obtained.<sup>4</sup> The substance has a high melting point. It is readily soluble in water or aqueous alcohol but is practically insoluble in absolute alcohol, ethyl acetate, benzene, toluene, carbon disulphide, carbon tetrachloride, acetone and ether.

Found: Ba = 22.87 per cent.; C<sub>20</sub>H<sub>30</sub>O<sub>8</sub>S<sub>2</sub>Ba requires Ba = 22.92 per cent. Previously, Pope and Gibson<sup>4</sup> had obtained barium salt with 3 H<sub>2</sub>O. They had also recorded that it loses its water of crystallisation when heated to 130°. It was observed by the authors that the hydrated salt had a variable composition and hence completely anhydrous salt was obtained by the method described above.

It was noted that like the calcium salt<sup>5</sup> of Reyckler's acid the barium salt also exhibits slight fluorescence under the influence of X-rays.

The rotatory dispersion measurements were carried out in a 2 dm. tube. Rotations for wavelengths Cd 5085, Hg 5461, Hg 5780, Na 5893, Ba 6142, Ne 6402, Ba 6497, Li 6708 were measured at room temperature. The results are recorded in Table I below.

TABLE I

Concentration 2.4503 g./100 ml.; Solvent-Water; Temperature 29° C.

Wavelength (λ)	[α] Observed (O)	[α] Calculated (C)	(O) - (C)
Cd 5085	.. +29.76	+28.85	+0.91
Hg 5461	.. 22.97	23.11	-0.14
Hg 5780	.. 19.57	19.57	± 0
Na 5893	.. 18.58	18.54	+0.04
Ba 6142	.. 16.38	16.53	-0.15
Ne 6402	.. 14.78	14.79	-0.01
Ba 6497	.. 13.98	14.22	-0.24
Li 6708	.. 13.18	13.09	+0.09

When the graphic analysis of the results was carried out, it pointed to a simple dispersion between wave-lengths Cd 5085 to Li 6708.

Mathematical analysis of the results shows that the dispersion can be expressed by Drude's

$$\text{one-term equation, namely, } [\alpha] = \frac{4.585}{\lambda^2 - 0.09979}.$$

The difference of the observed values from those calculated from the equation are recorded in column four of Table I. The observed values are in good agreement with those calculated from the equation.

Authors are grateful to the authorities of the University of Saugar for research facilities.

Department of Chemistry, O. N. PERTY.  
University of Saugar, S. R. K. MURTY.  
Saugar, M.P.,  
April 18, 1952.

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## A NEW RECORD OF A HYMENOPTEROUS PARASITE, APROSTOCETUS SP.

A NEW species belonging to the genus *Aprostocetus*, sub-family Tetratichinae, family Eulophidae was discovered breeding on the pupa of *Argyria sticticrasis*, Hmps.

Preliminary experiments on the potentialities of the parasite to breed on various Lepidopterous insects were tried all these years. The parasite bred successfully on the top borer of sugarcane (*Sciropophaga* spp.), Jowar stem borer (*Chilo* spp.), Wheat stem-borer (*Sesamia* spp.), *Crociodomia* spp. on cruciferous plants, Wax moth (*Galleria* spp.), Lemon butterfly (*Papilio demoleus*, L.), Anar butterfly (*Virachola isocrates*, F.), and *Corcyra cephalonica*, St. In these insects the pupal stage was very favourable for the parasite infestation. However, in the case of *Chilo* spp. the mature larva, before pupation was observed to be equally susceptible for the attack of the parasite. The number of parasites emerging from different insects was variable dependent on the size of the host, the smaller sized pupae providing for the development of lesser number of parasites than the bigger sized pupae.

The duration of the life-cycle ranged from 14 to 25 days depending on the prevailing temperature and humidity. The shortest duration was under an average maximum tempera-

ture of 87° F. and the minimum of 55.9° F. with an average humidity of 69.3% at 9 a.m. The longest duration of the life-cycle was under an average maximum temperature of 78.6° F. and the minimum temperature of 56° F. and 68.6 per cent. humidity.

The parasite can be easily bred on *Corcyra cephalonica*, St. The parasite appear to have great potentialities in the control of various insects which are not easily accessible to the chemical method of control. Further detailed investigations on the bionomics, life-history, mass production and the economic importance of the parasite are being completed and would be published in due course elsewhere.

The author is grateful to Dr. M. S. Mani, for identifying the parasite and to Shri K. D. Gumaste, for facilities afforded for the investigation.

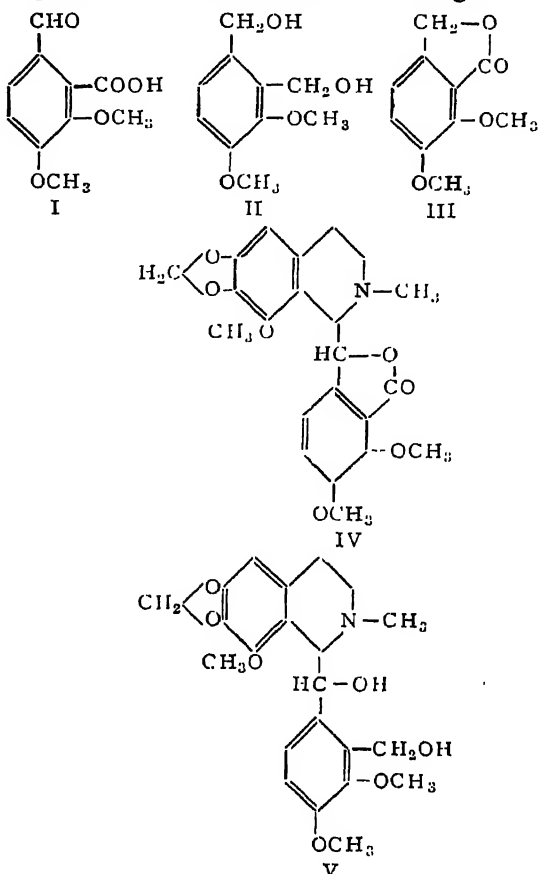
College of Agriculture, S. A. RAJA RAO.  
Dharwar,  
May 5, 1952.

#### PRESERVATION OF LACTONE RING WITH LITHIUM ALUMINIUM HYDRIDE

THE lactones are known to be reduced to the corresponding glycols with lithium aluminium hydride.<sup>1</sup> However, if the compound containing the lactone ring is dissolved in a mixture of ether and pyridine, the lactone is recovered even in presence of a large excess of the hydride and under conditions under which a lactone is reduced to a glycol. This phenomenon was noticed while reducing opianic acid (I) with lithium aluminium hydride in order to obtain the corresponding dimethoxyphthalyl alcohol (II). Owing to the insolubility of the acid in ether, in dioxane and in tetrahydrofuran, the acid was dissolved in the minimum amount of pyridine and then diluted with ether to the critical concentration at which the acid just remained in solution. The reduction product from such a solution proved to be meconine (III), the lactone of meconic acid. Similarly narcotine (IV), which is reduced to the glycol (V), in ether solution was recovered unchanged when reduced in a pyridine-ether solution.

It is conceivable that the lactonic compound, in presence of pyridine occurs as the pyridinium salt of the corresponding acid and the preservation of the ring is possible by the unreducibility of the salt with lithium aluminium hydride under mild conditions. This method of preserving the carboxylic group promises im-

mense potentialities for achieving selective reductions with lithium aluminium hydride and experiments in this connection are being studied.



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Hyderabad-Deccan,  
February 16, 1952.

RAFAT MIRZA.

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#### AN UNUSUAL FORM OF HAEMAG- GLUTINATION WITH CERTAIN POTATO EXTRACTS

EXAMINATION of saline extracts of various plants for hæmagglutinating activity for human red blood corpuscles reveals that extracts of the common potato (*Solanum tuberosum*) contain hæmagglutinins of a non-specific nature. These findings have not been reported previously. The extracts are prepared by soaking the potato overnight in an excess of water, draining off the water, adding an excess of isotonic saline, grinding in a mortar and filtering through ordinary filter-paper. Fresh ex-

tracts of certain fresh potatoes such as the Darjeeling Red Round potato produce very large agglutinates. The titre, however, is moderate, being only 128 against O, A and B cells. Such large agglutinates are not observed with extracts of various seeds such as *Ricinis communis*, *Dolichos lablab*, *Lathyrus sativus*, *Pisum sativum*, *Lens esculenta*, *Phaseolus vulgaris*, *Vicia faba*, etc., even though the titres of some of these are very high, for example, *Ricinis communis* (65,536). It is considered possible that some factor present in these tubers and not in the various seeds may be responsible for the production of large agglutinates. In this connection it is also noteworthy that extracts of other tubers, for example, *Ipomea batatas* (sweet potato), *Dioscorea esculenta* (potato yam) and *Dioscorea alata* (greater yam) do not contain hæmagglutinins, and, therefore, cannot provide confirmation of this assumption. An attempt is being made to identify the factor, if any. The information obtained may be useful in bringing about the enhancement of weak hæmagglutination reactions.

Thanks are due to the Director-General, Armed Forces Medical Services, India, for permission to publish this note.

Blood Transfusion Dept., G. W. G. BIRD.  
Armed Forces Medical College,  
Poona, March 10, 1952.

#### NOTE ON BHADURI'S TEST FOR PREGNANCY IN FARM ANIMALS

BHADURI<sup>1</sup> described a test for the diagnosis of pregnancy in farm animals, which consists chiefly of the injections of a faecal extract of the animal to be tested, into the male toad *Bufo melanostictus*. He claimed, that cases of pregnancy produced an emission of sperms by

the toad and presumed that this effect was possibly evoked by gonadotropic hormones excreted in the faeces of pregnant animals.

Cowie<sup>2</sup> stated that further confirmation of Bhaduri's interesting findings were needed, especially since Mitchell. Borasky and Bradbury<sup>4</sup> found that substances having gonadotrophin-like activities were found in plants which the cattle may ingest during feeding. Cowie<sup>3</sup> reviewing an article of Bhaduri, noted that he had failed to obtain positive response in the British toads.

Several tests were conducted in this laboratory with the faeces of pregnant, non-pregnant and the male animals on the local toads of *Bufo melanostictus*. With the exception of a very few cases, positive reactions were obtained in all the tests.

15 gm. of urine-free faeces were stirred thoroughly in 100 c.c. distilled water and kept overnight in a refrigerator. Next day the material was centrifuged and then filtered, and the process was repeated, if necessary, until a clear filtrate was obtained. This was injected, three to four times, in doses of 5 c.c. each, into the dorso-lateral lymph spaces of the male toad whose urine was previously examined for sperms, at half-hour intervals. The urine of the toad was then examined at intervals of every half-hour for ejected sperms under the microscope.

Positive reactions were first obtained in the pregnant animals and the tests were further extended to non-pregnant and male animals. The results obtained are given in Table I.

A reference was made to Dr. Bhaduri in this connection and he was kind enough to come down to our laboratory with six toads from Calcutta and parallel tests were conducted along with local toads, and the results are given in Table II.

TABLE I

Test animals	N. examined	Negative	Positive	Occurrence of positive reaction
1 Pregnant cows	18	1	17	Between 2nd and 3rd injection do
2 Non-pregnant lactating cows with 2-3 months old calves	20	1	19	
3 Sterile cows	4	1	3	do
4 Bullocks	16	4	12	do
5 She-buffaloes	10	2	8	do
6 He-buffaloes	8	3	5	do
Total	76	12	64	



TABLE II

Test animals	Hebbal Toad						Calcutta Toad						
	Injection		Schedule				Injection		Schedule				
	1 (5 c.c.)		1 (5 c.c.)				1 (5 c.c.)		1 (5 c.c.)				
	Observation in hrs.						Observation in hrs.						
	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2		0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
1 Pregnant cow	..	—	—	$\phi$	—	$\phi$	—	—	—	—	—	—	—
1 Pregnant cow $3\frac{1}{2}$ months	..	—	—	—	$\phi^*$	$\phi$	—	—	—	—	$\phi$	$\phi^*$	—
1 Lactating cow with 2 months calf	—	—	—	—	$\phi$	$\phi$	—	—	—	—	—	—	—
1 Non-pregnant sterile cow	..	—	—	$\phi^*$	—	—	—	—	$\phi^*$	—	—	—	—
1 Bullock	—	—	—	—	$\phi$	$\phi$	—	—	—	—	—	$\phi$	$\phi$
1 Bullock	..	—	—	—	—	$\phi^*$	—	—	—	—	$\phi^*$	$\phi$	$\phi^*$

\* Large number of sperms more than 30-40 in each field

We are led to conclude that:

- (1) Substances, similar in effect to gonadotrophic hormones, so far as they relate to the stimulation of Gameto-kinetic reaction in the male toad, are present in the faeces of pregnant, non-pregnant and male cattle. They are not confined to pregnant cattle alone as stated by Bhaduri. Their origin is not, however, clear.
- (2) It, therefore, requires further investigation to know whether such results are due to factors in the feed of the local cattle.

Our thanks are due to Dr. J. L. Bhaduri, for all his help while conducting the parallel tests in our laboratory and Dr. P. M. Narayanaswamy Naidu, under whose instructions this work was undertaken, and to Dr. L. S. Ramaswami, for having identified the toads and for his kind interest.

Mysore Serum Inst., N. S. KRISHNA RAO.  
Hebbal, H. V. KRISHNAMURTHY.  
Bangalore, June 10, 1952.

1. Bhaduri, J. L., *Presidential Address, 38th Science Congress, Bangalore, 1951*. 2. Cowie, A. T., *Pregnancy Tests, The Veterinary Record*, 1951, **63**, 371-2. 3. —, *Ibid.*, 1952, **64**, p. 115. 4. Mitchel, J. W., Borasky, R. and Bradbury, J. T., *Endocrinology*, 1942, **31**, 283.

\*\* Not seen by the authors in the original.

### RADIO-FREQUENCY OSCILLATIONS IN A.C. SILENT DISCHARGES

WARBURG<sup>1</sup> in his investigations on the A.C. discharge in Siemen's ozonizer came to the important conclusion that the A.C. discharge current through the ozonizer had components, the frequency of which was very high compared to that of the applied voltage ( $\sim 10^5$ - $10^6$  c.p.s.).

In investigating the Joshi Effect, Prasad<sup>2</sup> in Joshi's Laboratory devised a method in which the high frequency components of the ozonizer were picked up by an aerial and measured by means of a suitable detecting device. In the present communication we shall give direct experimental evidence of RF oscillations of discrete frequencies occurring in ozonizers and also in A.C.-operated discharge tubes, fitted with external 'sleeve'-electrodes.

Ozonizer tubes containing iodine vapour, hydrogen and nitrogen gases and also 'sleeve'-discharge tubes filled with hydrogen, chlorine and iodine vapour were excited by a suitable high voltage of 50 c.p.s. In each case there was distinct evidence of RF oscillations which could be tuned by the variable condenser of a radio receiver at some discrete frequency channels. A long vertical copper wire connected to a coil wound on each tube was used as a radiating antenna. A T.R.F. receiver or a receiver of the superhet type, worked with a receiving T-aerial was employed to detect the RF oscillations. A mirror galvanometer, with no-signal anode current balanced out, was placed in the anode circuit of the detector valve of the T.R.F. receiver (or in the anode circuit of the second detector valve of the superhet receiver). A loudspeaker at the output end after AF amplification was also used for getting the aural response.

The frequencies of the RF oscillations produced in the various discharge tubes when excited by 3,000 volts (50 c.p.s.) are given in Table I. The frequencies were obtained from the peak values of the resonance curves showing the mean rectified output current for the various positions of the tuning condenser of the receiver. As many as seven different fre-

TABLE I

Discharge tube	Frequencies of R/F oscillations (Mc/s)	Ratio of frequencies
1. Hydrogen ozonizer	.. 2.8, 4.8, 6.7, 8.6	3:5:7:9
2. Iodine ozonizer	.. 1.25, 3.5, 5.0, 7.7	1:3:4:6
3. Nitrogen ozonizer	.. 9.8	..
4. Hydrogen 'sleeve'-tube	.. 4.2, 4.9, 6.8, 8.9, 10.0, 11.9, 15.0	4:5:7:9:10:12:15
5. Chlorine 'sleeve'-tube	.. 4.2; 4.9, 6.8, 8.9, 9.8, 12.0, 14.2	4:5:7:9:10:12:14
6. Iodine 'sleeve'-tube	.. 4.2, 4.9, 6.6, 8.9, 9.8, 11.9, 14.2	4:5:7:9:10:12:14

quencies were observed in some of the 'sleeve'-discharge tubes. They appear to bear to one another a more or less simple ratio, suggesting overtones of an oscillating system.

For a given distance between the electrodes, it was found that the frequency of any one of the RF oscillations remained practically constant over a wide range of applied voltages. It was also found that for a fixed applied voltage, the frequency of the RF oscillations was independent of the distance between the electrodes.

It should be mentioned that the RF oscillations produced in the AC 'silent' discharges were modulated by the AF pulses which are now known to be associated with the Joshi Effect. It was thus possible to hear a distinct sound on the loudspeaker, when the receiver was tuned to one or another of the radio frequencies. The sound was found to increase or decrease on irradiation, according to conditions favourable for the production of positive or negative Joshi Effect. The galvanometer in the T.R.F. receiver was also able to show this photo-effect. As the RF oscillations were modulated by the Joshi Effect pulses much above 100%, the galvanometer in the superhet receiver also

could reveal the photo-effect. These experimental results will be given elsewhere.

With regard to the origin of the RF oscillations produced in the AC 'silent' discharges, it should be recalled that such oscillations in DC gas discharges were long known from the theoretical and experimental work of various investigators.<sup>3</sup> Judging by the fact that the frequency of the RF oscillations in AC 'silent' discharges is not dependent on the magnitude of the applied voltage or on the distance between the electrodes, it appears extremely unlikely that they are of plasma-electronic origin. The origin of the observed RF oscillations in AC 'silent' discharges will be discussed elsewhere.

Wireless Laboratory, S. R. KHASTGIR.  
Benares Hindu University, P. S. V. SETTY.  
May 25, 1952.

1. Warburg, *Verhand. Deutsch. Phys. Ges.*, 1903, 382; — and Leithanser, *Ann. der Physik*, 1903 28, 1. 2. Prasad, *Proc. Ind. Acad. Sci.*, 1949, 29, 322. 3. Penning, *Nature*, 1926, 118, 301; *Physics*, 1926, 6, 241; Webb and Pardue, *Phys. Rev.*, 1928, 31, 1122; *Ibid.*, 1928, 32, 946; Tonks and Langmuir, *Ibid.*, 1929, 33, 195, 990; —, *Ibid.*, 1931, 37; Thomson, J. J., *Phil. Mag.*, 1931, 11, 697, *Proc. Phys. Soc. (Lond.)*, 1928, 40, 82.

#### OBITUARY—DR. M. B. SOPARKAR

WE regret to announce the death of Dr. Manmohandas B. Soparkar at Bombay on May 31, 1952.

The late Dr. Soparkar was born in Poona on April 10, 1884, and was educated in Poona and the Grant Medical College, Bombay, where he took the M.D. Degree in 1913.

In 1918 Dr. Soparkar devised a special medium (Soparkar Medium) for the cultivation of the influenza bacillus. After the First World War when many Indian soldiers infected with human Schistosomes returned to India Dr. Soparkar investigated the problem of the likelihood of the disease spreading in India. He found larval forms of several trematode parasites including animal Schistosomes which he studied and described in detail.

Dr. Soparkar continued to work at the Haffkine Institute since 1914 on tuberculosis. He described the method of cultivation of the tubercle bacillus and studied the vitality of the organism under natural and artificial conditions and the channels of spread of the disease in human beings. He also studied the various aspects of animal tuberculosis. In 1935 Dr. Soparkar was appointed Assistant Director, Haffkine Institute, and worked on plague. His work includes investigations on cholera at the King Institute, Guindy, Madras. He was elected Fellow of the National Institute of Sciences of India in 1937 and President of the Medical Section of the Indian Science Congress in 1949.

K. M. SOPARKAR.

## REVIEWS

Carburation (in Two Volumes, 3rd Edn. Revised). By Charles H. Fisher. (Chapman & Hall), 1951. Pp. Vol. I: xv + 356; Vol. II: xv + 279. Price 36 sh. each.

From the outset of the Development of Internal Combustion Engineering, the atomization of the fuel has been a corner-stone in the design of the engine. The controversy between carburation and fuel injection has started at an early date and pursues till this very day. It is, therefore, surprising that this subject has found so little attention in the freely accessible technical literature. One of the very few books to deal with this subject was written by Charles H. Fisher and published under the title *Carburation and Carburettor*, in 1939. This has recently been published in its third edition, and now appears in two volumes.

The first volume is concerned mainly with the theoretical background of Carburation. After a general introduction dealing mostly with the fundamental principles, the book lists the collected data on fuels, which are indeed valuable.

The two following chapters give a detailed outline of air-fuel ratios and mixture characteristics, leading to a description of general carburettor operation. In Chapter 5, the physical background of the hydraulics of carburettor is given, thus making it clear in which way a particular mixture strength is obtained and how the working of the carburettor is influenced by changes in its surroundings. Examples of the design principles of well-known carburettors are included and they are well assisted by a number of illustrations. The interdependence between the carburettor and the intake manifold system in reference to different types of engines and the manifold design is described and an account is given of the methods of testing, and the working of the carburettor in the engine. The last chapter deals with aircraft carburation and petrol injection and describes the particular and complex circumstances under which carburation has to function in aircraft power plants. The effects altitude and ising on the working of the carburettors are brought out very impressively. Due importance is given to carburettors working with injection and the general principle of injecting petrol into the inlet manifold. In the

later part of this chapter, adequate space is provided for a description of direct petrol in its general aspects and in its detailed technicalities. It is felt, however, that this new field of direct fuel injection should have called for a special chapter, since in more recent days it appears that fuel injection may have a considerable bearing on the fuel economy of the engine and especially on the increase in compression ratio. This is especially so for high powered engines, but as the examples of some new-comers in the field show, petrol injection will lead to considerable saving in fuel for very small engines, particularly for small two-stroke engines.

The second volume is meant especially for the reader with a practical outlook. It refers mainly to the installation of the carburettor and its relations to a particular engine. It deals with the methods of tuning and testing of engines on the road and on the test-bed. The apparatus necessary for those tests is described and attention is given also to the calibrating of jets. The rest of the book gives a wealth of information on construction, installation and maintenance of a number of well-known carburettor types. These data will certainly prove extremely handy. The volume concludes with the problem of automatic control of cold starting mixtures.

The first volume will be indispensable for those who seek advanced information on the principles of carburation, while the second will be very valuable to the practical engineer who is in charge of repairs and maintenance of petrol and vaporising oil engines.

H. A. HAVEMANN.

*Fundamentals of Optics.* By Francis A. Jenkins and Harvey E. White. Second Edition. (McGraw Hill Book Company). Pp. 647.

The book under review is an enlarged and revised second edition of the *Fundamentals of Physical Optics* by the same authors published in 1937. As the change in the title would indicate, the book now embraces the entire field of optics. It consists of three parts treating respectively with Geometrical Optics, Physical Optics and Quantum Optics.

The first part dealing with Geometrical Optics is a welcome addition and gives a systematic,

precise and lucid exposition of the fundamental principles of the subject. The chapters on thick lenses, the effect of stops and lens-aberration are particularly thorough. A large number of numerical examples have also been worked out.

The section on Physical Optics rightly occupies the major part of the book. It is substantially the same as in the first edition, but has been carefully revised with a view to improving the clarity and rigour of its presentation and to include brief accounts of recent developments in applied optics such as phase contrast microscopy, non-reflecting films, interference light filter and Schmidt Camera. Emphasis has been rightly placed on the fundamental principles as well as on the experimental aspects and practical applications of the subject.

The third part on Quantum Optics is a very brief review of the important landmarks in the photon theory of light. It is obvious that exigencies of space have prevented a fuller discussion of the quantum theory of optical phenomena. The book is characterised by lucidity which has been attained without sacrificing precision. A number of numerical examples have been given at the end of every chapter with answers for even numbered ones, which should enable the serious student to check up his understanding of the subject-matter. The book which has an excellent get-up and is superbly printed, should find a place in every Physics Library.

C. S. V.

**Strain Gauges: Theory and Application.** By J. J. Koch, R. G. Boiten, A. L. Biermatz, G. P. Rosz, and G. W. Yan. (Philips Technical Library), 1952. Pp. 95. Price not given.

In experimental stress analysis work, the use of variable resistance wire-strain gauges has become the most widely used technique. The book under review, the co-ordinate work of several authors, gives a concise but comprehensive description of the technique and use of the strain gauges.

The first two chapters deal with the various forms of strain gauges and the principles used in measuring and the various measuring apparatus. The third chapter deals with the fixing of the strain gauge elements and their connection to the instrument. Chapter four discusses the various factors involved in measurement, the errors that may get in, and the method of eliminating the same.

Chapter five gives in a comprehensive manner the theories of failure and evaluation of

strain measurements. The last chapter deals with the application of strain gauges and a brief description of the instruments.

The book is very useful for work in experimental stress analysis and is a valuable addition to any personal or research library.

K. SEETHARAMIAH.

**1950 Supplement to Screw-Threads for Federal Services 1944.** (The National Bureau of Standards, Washington, U.S.A.). Price 50 Cents.

Lack of interchangeability of screw thread parts has been a severe handicap for users of mechanical equipments in different countries. Unification of screw-thread standards was adopted by representatives of the United States, United Kingdom and Canada recently. This accord will go a long way in removing the barriers for exchange of manufactured goods. This hand-book presents the United Standards for thread forms, both coarse thread series and fine thread series in sizes from  $\frac{1}{4}$ " to 4" and  $\frac{1}{4}$ " to  $1\frac{1}{2}$ " respectively. It also includes unified threads of special diameters, pitches and lengths of engagements. This was agreed upon subsequent to the accord mentioned above and have been formulated on the same basis as the unified standards. Wire methods of measurements of pitch diameters have been dealt with clearly and adequately in Appendix 2 of this book. Tables are presented giving the details of screw-threads which will be valuable to everyone engaged in the manufacture of bolts, screws, nuts and other threaded parts so that they may conform to the unified standards. This supplement must of necessity be maintained by every production workshop in the country.

A. RAMACHANDRAN.

**The Chemistry of Lignin.** By Friedrich Emil Brauns. (Academic Press Inc., New York), 1952. Pp. 808. Price \$14.50.

This exhaustive monograph in 27 chapters deals with the distribution, colour reactions, isolation and determination of lignin, its physical properties and elementary composition acylation and alkylation, halogenation, nitration, sulphonation, hydrolysis, alcoholysis, mercaptalysis, phenolysis, reduction, hydrogenation and hydrogenolysis, oxidation, alkali fusion and special reactions of lignin, thermal and biological degradation, theories of the structure of lignin, linkage in the plant, forma-

tion and synthesis of lignin. It is probably the only detailed work on the subject written by one who has himself so largely contributed to the subject, and fills a long-felt want. The book is eminently readable, and as far as possible gives full details, thus saving the necessity to refer to original literature which sometimes may be hard to get at.

On page 22 the author refers to some results of Cieslar. It may be mentioned that similar results have been obtained by the reviewer, viz., decrease of lignin content with height in some conifers. The chapter on the physical properties of lignin is fairly complete. Mention of magnetic properties (*vide* P. Nilakantan, *Proc. Ind. Acad. Sci.*, 1938, 7 A, 38) and dielectric properties (*vide* Kroener, *Dissertation*, Braunschweig, 1943) would have made it more complete. In the chapter on synthetic lignins no mention is made of the synthesis of "lignin" from coniferyl alcohol with the help of a dehydrase reported by Freudenberg. Possibly the book went to the press before this work was published. A chapter on the applications and uses of lignin and on the thermal plasticisation of lignin would have been useful. Sandalwood is *Santalum album*. The common name for *Pterocarpus santalinus* is red sanders. Sometimes it is called red sandalwood (p. 139). There are a few printing mistakes in the book. Some of the structural formulæ on pages 507 and 508 also require slight rectification. Considering that the book was printed in a non-English-speaking country the errors are few. The work can be warmly recommended as a reference book to all those who have to do with the chemistry or applications of lignin.

D. NARAYANAMURTI.

**Application of the Electronic Valve in Radio Receivers and Amplifiers.** By B. G. Dammers, J. Haantjes, J. Otte and H. Van Suchtelen. Pp. 425. Philips Technical Library. (Published by N. V. Meulenhoff & Co., Amsterdam), 1951. Price not given.

The present volume is the work of four well experienced members of the scientific staff of the Philips Company and forms the second of the series of three books devoted to the application of electronic tubes in radio receivers and amplifiers. The authors are to be congratulated for the thoroughness with which the subject has been treated and for providing detailed information about practically every aspect of audio frequency amplification except the subject of inverse feedback. In view of the im-

portance of the latter in connexion with audio frequency amplification the appearance of the third volume which would deal with the subject is eagerly awaited.

The book is divided into three chapters. The first chapter deals with the audio frequency amplifying circuits, phase inverting stages, the frequency response, the design and characteristics of audio frequency transformers and non-linear distortion. Numerous calculations have been given for illustrating the subject-matter. The second chapter deals with various adjustments, distortion, behaviour under complex load and overload phenomena of the output stage, with a thoroughness which is highly commendable. A large number of graphs and numerous design calculations have been given to illustrate the use of different types of valves in different circuits. The treatment of the double tone method is especially noteworthy. The third chapter deals with the power supply system for the filament and the H.T. and discusses the design procedure for stabilised supply voltage for the H.T.

The clear and systematic treatment of the book makes it undoubtedly a valuable addition to the literature of the subject. This book is recommended to those especially engaged in the design work of audio frequency amplifiers.

S. K. C.

**The Enzymes—Chemistry and Mechanism of Action.** Edited by James B. Sumner and Karl Myrback. Vol. I, Part 2. (Academic Press Inc., New York), 1951. Pp. x + 725-1,361. Price \$12.8.

The second part of the first volume contains 24 contributions which cover some of the most important groups of enzymes. Among these are proteolytic enzymes by Emil L. Smith, urease by Sumner, the distinguished Editor, who crystallised the enzyme, Arginase by Greenberg, Carbonic Anhydrase by Roughton, the discoverer of this enzyme, Enolase by Mayerhof who found it as one of the essential components of the glycolytic system, phosphorylases with special reference to phosphorylase and synthesis of saccharides by Hassid and his collaborators, Transaminases by Cohen, Transmethylnases by Sourker, Penicillinase by Abraham, Thiaminase by Harris and Nucleolytic Enzymes by Laskowski. The lesser known of the enzymes, e.g., Cellulases and related enzymes, have received attention at the hands of Pigman. Pectic enzymes have been reviewed by Kertesz, one of the pioneers

in this field. The enzymatic hydrolysis of mucopolysaccharides is reviewed by Fishman.

Enzymes responsible for the coagulation of milk and blood have received their share of attention in this volume. Particularly valuable is the contribution of Seegers who has surveyed the field of blood coagulation. Reviews devoted to a discussion of the other relatively unstudied enzymes, viz., Allantoinase and Allantoicase, Hippuricase, Histidase and Urocanase, Fumarase and Aconitase, Desulphhydrases and Aspartase, will serve to highlight the problems awaiting elucidation and to stimulate further work on these rather obscure and ill-defined enzyme systems.

Twenty-six foremost workers in the field of enzymes from Europe and America have participated in the presentation of the 24 topics referred to above. This volume as the previous one already reviewed, will be warmly welcomed with appreciation and gratitude by a wide circle of investigators interested in Enzymology in its most comprehensive sense.

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**Adhesives for Wood.** By R. A. G. Knight. (Monographs on Metallic and Other Materials, Vol. III). (Published by Chapman & Hall), 1952. Pp. 242. Price 25 sh.

This book by R. A. G. Knight of the Forest Products Research Laboratory Princes Risborough in 22 chapters deals with adhesives in general, factors in gluing technique, survey of conditions under which adhesives are used and the testing of adhesives. According to the author the purpose of the book is to "serve as a text-book for the younger technician and to provide a work of reference". The form of presentation, which differs from other books, has been guided by the author's experience in general liaison work between research and industry and in particular by the collaboration between the Forest Products Research Laboratory and the Research and Development Materials Branch of the Ministry of Supply and contains information not readily available to the general public. The book has a rather practical bias. It is written in a concise and readable manner containing useful tips and would particularly be of assistance to those engaged in gluing.

Chapters 15 to 17 on survey of conditions under which adhesives are used are not usually so exhaustively dealt with in similar books, but the departure should be welcomed as it is of great practical importance. The reviewer would agree with the author that it

is not safe to use U.F. glues for extreme service conditions.

On page 27 the author refers to the soaking of protein glues in formaldehyde. The use of protein-formaldehyde dispersions does not find a place. On page 58 "it is stated that plywood made with thermosetting glues usually undergoes a permanent compression of 5% . . . .". But this will vary with species, moisture content, temperature, etc. On page 59 "It is said that pressures of 400 p.s.i. lead to what are virtually starved joints". This is not always true. The chapter on the identification of the adhesive in a joint is rather meagre. In considering the effect of shrinkage on page 118 the work of Dietz and Grinsfelder could have been mentioned. On page 75 it is stated that borax and boric acid treated veneers can be satisfactorily glued with P.F. film glue. This contradicts Madison Report R 1427.

On page 93 while discussing alkalinity and acidity some examples of timbers having alkaline or acid reactions or extractives affecting glue adhesion could have been mentioned. On page 43 water-alcohol or 5% caustic soda solutions are recommended for cleaning P.F. coated surfaces. The reviewer has witnessed this for metal roller spreaders being done by high pressure live steam in a very efficient manner. The book is remarkably free from printing errors and mistakes. On page 18 last line "Ward" should be "Wood". Page 158, 2nd para, 2nd line, "adherent" should read "adherend". "Grinstead" should read "Grinsted" and "Del Monte" should read "Delmonte" wherever these names occur.

D. NARAYANAMURTI.

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**The Elements of Field Geology.** By G. W. Himus and G. S. Sweeting. (University Tutorial Press, London. Agents: Oxford University Press, Madras-2). Pp. viii + 268. Price Rs. 11-6-0.

The book is divided into two parts; the first part consisting of ten chapters deals with the procedure to be followed when examining a district of simple structure, with or without the aid of a geological map.

Chapters IV to IX deal in successive stages with the art of geological mapping and contain valuable hints and instructions in simple and clear language of the methods of observation, recording and interpretation of geological formations and structures in the field. Chapter VIII is of particular value to students introduced for the first time to geological mapping, as gradual stages of geological survey of an area

are given in clear language with the appreciation of the difficulties that confront a novice in field work. Chapter X details the methods of interpretation of the geological data where a three-dimensional image has to be conceived from two-dimensional plans.

The second part consisting of Chapters XI to XV gives data, where possible in tabular forms, for easy identification in the field, of common minerals, rocks and fossils. These chapters will be of real value to junior students and amateur geologists for easy identification of their collections in the field which is very essential to form a correct estimate of the geology of an area under investigation. The three appendices on 'Safety Precautions', 'The Geological Column' and 'Literature Reference for Further Studies', are useful to those for whom the book is intended.

A few mistakes have crept into the text which may be corrected in the second edition: P. 24, para 3 first line under (i) a comma is helpful to prevent confusion of the meaning, after "valley". P. 88, l. 21, obviously "assimilated" is an inappropriate term. P. 57, Fig. 22, letter 'e' is missing in the name Debenham. P. 64, on the map, "flallening" is an obvious misprint for flattening. P. 106, l. 26, 'indentifiable' is a misprint for 'identifiable'. Pp. 37 and 66, lines 2 and 11 respectively, 'shaley' appears to be a misprint for 'shaly'; likewise 'platy' is spelt as 'platey' on page 124, Table E.

The book is in many respects a unique and useful addition to geological literature and is eminently suited to be prescribed as a text book for the Degree and Honours courses in Geology in our Universities. Those who wish to be amateur geologists will find it a valuable companion. The authors have done a distinct service to students of geology in bringing out this very helpful book on field geology.

C. MAHADEVAN.

**"Analar" Standards for Laboratory Chemicals.** (Formulated and issued jointly by the British Drug Houses, Ltd., and Hopkins & Williams, Ltd., London), 1949. Fourth Edition. Pp. xviii + 302. Price Rs. 10.

Two British firms of established reputation in the field of laboratory chemicals have jointly issued the fourth and enlarged edition of their well-known handbook of specifications of what is familiarly and widely known as Analar Reagents. They have rendered a great service to science and industry by manufacturing the reagents of specified standards, so that scientific workers could use them with confidence.

The fourth edition includes fifty-eight new Analar Chemicals which generally fall into two subclassifications: (a) reagents for inorganic analysis, including the detection and determination by gravimetric, colorimetric and other means of both metals and acid radicals, and (b) reagents for the identification of organic substances by the formation of derivatives of definite melting points.

With the development of analytical methods of greater sensitivity and increased accuracy, higher standards of purity of the reagents are demanded, and there is, therefore, a continual need for revising the Analar Standards. Microbiological assays of amino acids and the partition paper chromatography represent two such recent developments. The reagents needed for this type of analysis are far more exacting than what is furnished by the "Analar" reagents. The enlightened firm of the British Drug Houses have already in their catalogue introduced amino acids of "Microbiological Assay" quality. Even more exacting are the standards needed for chromatographic analysis. We have found that some samples of the "purest" amino acids fall far short of the standard purity needed for chromatographic purposes. The British Drug Houses and Hopkins and Williams, are continually keeping abreast of these developments and cater to the exacting requirements of the scientific men. The volume under review is not only a helpful guide to an intelligent use of the reagents but also a valuable reference book furnishing data pertaining to the physical and chemical properties of the substances with which it deals.

**Thiophene and Its Derivatives.** By H. D. Hartough. (Interscience, New York), 1951. Pp. i-xvii + 1-533. Price \$ 16.50.

The third volume in the series of monographs on heterocyclic compounds, edited by Weisberger, is of outstanding interest and importance. Thiophene chemistry before 1941 has been summarized in two books by Victor Meyer and by Steinkopf, and the present volume gives a complete account of thiophene chemistry, elaborating in particular the great advances made since 1945. As a result of the production of thiophene by the Socony Vacuum Company by the interaction of *n*-butane with sulphur, thiophene chemistry has been intensively studied during the last few years. Much of the recent work on thiophene and its derivatives is due to Hartough, who therefore writes on the subject with authority. The book amply fulfils its

object of stimulating interest in new uses for thiophene as a raw material for synthesis. F. F. Blicke contributes a chapter on "Biological and Pharmacological Activity of Thiophene and Its Derivatives". "Molecular Structure and Spectroscopy of Thiophene and Its Derivatives", have been discussed by F. P. Hochgesang, who includes much unpublished work carried out in the Socony Vacuum Laboratories. Chapters VI to XVI give an exhaustive treatment of the entire chemistry of thiophene and its derivatives, Chapter XIII including unpublished work of Brooks on derivatives of 3-thiophenethiol. A valuable feature of the book is the description of preparative methods for a large number of thiophene derivatives, which are of interest as intermediates for further synthesis. The physical properties of compounds are listed in tabular form throughout the book. K. V.

**Citrus Products—Chemical Composition and Chemical Technology.** By J. B. S. Braverman. (Interscience Publishers, New York), 1949. Pp. xiv + 424. Price \$9.00.

Citrus fruits and citrus products, by virtue of their high vitaminic and nutritional values and also by virtue of their industrial importance, have evoked world-wide interest although their cultivation is limited to certain favoured tracts of the globe. Literature available on the subject is scattered throughout scientific and technological literature and texts on the subject had grown out of date as a result of rapid advances made in this field. The volume under review represents a comprehensive and compact treatise furnishing information and data on the horticultural, chemical and technological aspects of the subject.

The volume is presented into two parts: the first dealing with the chemical composition of the constituents of the fruit and the second, describing the technological aspects of the utilisation and manufacture of citrus products. Processing of citrus juices—concentrated, frozen, sweetened and fermented juices, preparation of jams, jellies and marmalades, are some of the subjects treated in the volume. Reference is made to the manufacture of citric acid both from citrus fruits and by the fermentation method.

The author is the Director of Research of the Central Citrus Products Research Laboratory of Israel, famed for its luscious citrus orchards. The author who is entitled to speak with first-hand knowledge of the subject, has presented in this volume the accumulated experience of twenty-five years of applied work on

the utilisation of citrus fruits and their by-products.

The various methods for the utilisation of the byproducts like citrus peels and citrus pectin are described. Standard specifications for some of the citrus products, drawn up by the United States, United Kingdom and Israel, are given in Appendix II.

**Advances in Genetics, Vol. IV.** Edited by M. Demerec. (Academic Press Inc., New York), 1951. Pp. ix + 343. Price \$7.50.

The fourth volume in this series is a welcome addition to the literature on genetics, containing as it does nine contributions on selected topics by leaders in the particular field. There is an article on theoretical genetics "Possible significance of duplication in evolution," by S. G. Stephens. Of the remaining eight articles, three pertain to plant genetics and five to animal genetics. The special field in animal genetics 'Drosophiletics' has two articles, one on heterochromatin and the other on lethal factors. These two and the contribution on physiological genetics of the mouse by Salome Gluecksohn-Welsch pertain to the study of gene action.

For plan-breeders the article on cotton breeding by T. R. Richmond is of interest. Though it deals only with breeding of Upland cotton for the United States, the problems and techniques of cotton breeding are well discussed. The articles by Krug and Carvalho on genetics of *Coffea* and by Seijin Nago on rice genetics would prove useful, as they are based on original work and summarises publications which are not easily accessible.

The book is essential to all biology libraries. The workers on specialised aspects of genetics can easily learn of developments in other fields with the help of this series. The printing and get-up are of the usual high standard.

C. G.

#### Books Received

**A Guide to Filter-Paper and Cellulose Powder Chromatography.** By J. N. Balston and B. E. Talbot. (M/s. H. Reeve Angel & Co.), 1951. Pp. 1 + 145. Price 8 sh.

**Biochemical Society Symposia No. 8, Metabolism and Function in Nervous Tissue.** (M/s. Cambridge University Press), 1952. Pp. 102. Price 12 sh. 6 d.

**Science and Culture.** (Selection of Passages from the Writings of Sri Aurobindo and the Mother). Compiled by Indra Sen. (Aditikaryalaya, Pondicherry), 1951. Pp. 116. Price Re. 1-8-0.



## SCIENCE NOTES AND NEWS

### Colour Response in Insects

Sri. A. B. Saran, N. P. Tiwary and B. N. Sahay, Botanical Section, Sabour, write as follows:

The differential response of insects to colour-different lights has been reported before.<sup>1,2,3</sup> Our field experiments with hurricane lanterns using different kinds of light round a set of plots which were infested with Gundhi bugs (*Leptorhiza varicornis* F.) and stem-borers (*Schæobius bipunctifer* Wlk.) show that the best result is obtained with white light. Red light proved to be very ineffective.

1. Bertholf, Lloyd M., *Jour. of Agr. Res.*, 1931, **42**, 79. 2. Frisch, K. Von, *Dtschen. Med. Wchschr.*, 1913, **39**, 15. 3. Imms, A. D., *Recent Advances in Entomology*, 937.

### Tata Gold Medal for Zoological Research

The Zoological Society of India will award the Sir Dorabji Tata Gold Medal for the best research done in Zoology between January 1948 to December 1951. Research workers are therefore requested to send details of work done by them during this period, with copies of reprints of papers (which will be deposited in the library of the Society) to Dr. M. A. Moghe, Registrar, Poona University, Ganeshkhind, Poona-7.

### Dr. Lal C. Verman

Dr. Lal C. Verman, Director, Indian Standards Institution, was re-elected Vice-President of the International Organisation for Standardisation (ISO) at the annual meeting of its Governing Council at New York.

### Travancore Monazite Factory

The monazite factory set up by the Atomic Energy Commission of India in Travancore is expected to go into production shortly and will produce rare earth compounds, trisodium phosphate, crude thorium hydroxide and dilute caustic soda solution. Another factory for the production of uranium and thorium compounds is proposed to be set up shortly. This factory will be self-supporting and will meet its operating cost through the sale of its thorium compound to the indigenous gas mantle industry.

Raw materials used by the factory will be uranium-bearing ores located by the rare

minerals survey unit of the Commission and thorium-uranium-bearing residues of the Indian Rare Earths Ltd., Alwaye.

### International Mathematical Union

Plans for an International Mathematical Union were discussed at the International Congress of Mathematicians held in Cambridge, U.S.A., in August-September, 1950. Of the participants from India, Professor D. D. Kosambi was elected a member of the preparatory committee. The IMU has now been constituted, adhering countries forming national committees. The first General Assembly which was held in Rome recently elected for the period 1952-54 Professor M. H. Stone (U.S.A.), President and Professor Bompiani (Italy), Secretary; the office will be at 22, Via Verona, Roma, Italy.

The first activities of this new Union will be the preparation of a World Directory of Mathematicians, the re-establishment of the International Mathematical Instruction Committee and the publication of a news bulletin. The Union will also devote its attention to the problem of abstracting and reviewing and the publication of a polyglot directory of mathematical symbols. It will give all possible support to the next Mathematical Congress scheduled for Amsterdam in 1954.

### Standard Nomenclature for Pest Control Products

A standard list of coined common names has been issued by the British Standards Institution for established pest control products, embracing insecticides, insect repellents, acaricides, nematocides, fungicides, herbicides and rodenticides. These names do not conflict with proprietary names, but are intended for common use to assist users in the identification of the active ingredients of pest control products having otherwise cumbersome technical names. It is emphasized that these names are in no way proprietary, but in order to pre-empt as far as possible their availability as common names they have been recorded, though not registered as Trade Marks, by H.M. Patent Office.

Copies of this standard (B.S.1831; Part I, 1952) may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1, Price 2/6.

**Photo-Sensitised Glass**

Using a special photo-sensitive glass that is opaque, Corning Glass Works, have developed a photo-chemical etching technique that would appear to have many applications in the fields of lighting, photo-engraving and electronics. A trace of silver compound is used to make the glass photo-sensitive. The operator places an ordinary photographic negative on the photo-sensitive glass and exposes it to the ultra-violet light. The glass, which still appears clear, is then placed in a high-temperature furnace. Oven-heating at approximately 1,200° F. for about an hour causes a milk-white image to appear, caused by crystallization of certain elements in the glass.

**Recognition of A.P.T.I. Diplomas**

The Government of India, in consultation with the Union Public Service Commission, have decided to recognise the All-India Senior Diplomas in Commerce, Engineering and Chemical Engineering and Technology awarded by the Association of Principals of Technical Institutions, India, in 1945, as equivalent to corresponding University Degrees for purposes of recruitment to posts under the Central Government.

**Award of Research Degree**

The University of Poona has awarded the Degree of Doctor of Philosophy in Chemistry to Sri. S. S. Pathak for his thesis on "Studies in Hydrogenated Fats with Special Reference

to Toxicity of Nickel and Nutritive Value of Iso-oleic Acids."

**Free Flow of Information Materials**

An International agreement, the first to come into operation under UNESCO's sponsorship, seeks to eliminate customs duties on books, newspapers, magazines, paintings and sculpture. Also exempt are travel literature, musical scores, manuscripts and articles for the blind. Free import is likewise granted to educational films and filmstrips, newsreels, sound recordings and other audio-visual and scientific equipment. These materials, however, are exempt only if consigned to recognised institutions such as libraries, schools, universities, research laboratories, museums and broadcasting organizations.

**Substitutes for Nickel**

Shortage of nickel for electroplating is being met in Australia by the use of speculum (55 per cent. Cu, 45 per cent. Sn), bronze (90 per cent. Cu, 10 per cent. Sn), tin-zinc (80 per cent.—20 per cent.) and white brass (80 per cent. Zn, 20 per cent. Cu) as substitutes.

**Electro-Chemical Society, India Section**

At the Second Annual Meeting of the Section held on June 27, 1952, the following Officers were elected for 1952-53: *Chairman*: Professor M. S. Thacker, Bangalore; *Vice-Chairmen*: Charat Ram, Esq., Delhi, and Mr. K. Rajagopal, Mettur Dam; *Secretary-Treasurer*: Mr. J. Balachandra, Bangalore.

**ATOMIC ENERGY AT HARWELL\***

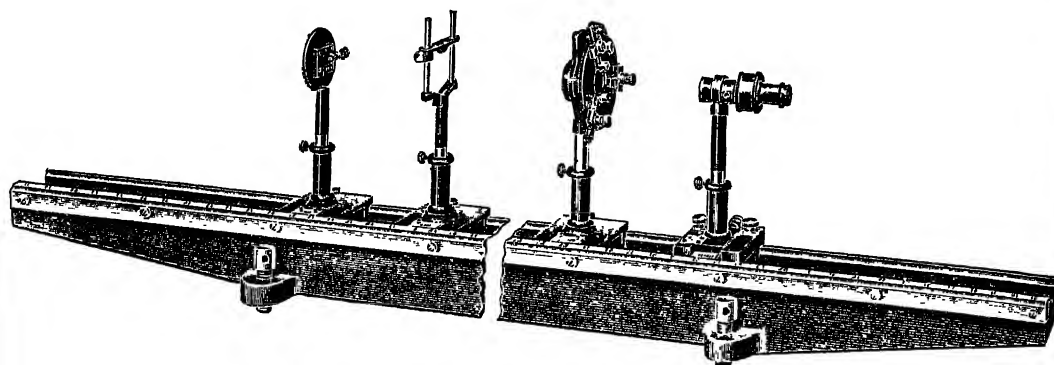
THE first official account of research work done during the last five years by the Atomic Energy Research Establishment at Harwell has been released in book form under the title 'Harwell'. The book gives an account of the research establishment from its inception to its present status, a review of the isotope reactor and accelerator programmes, a full treatment of health hazards and protective measures, fundamental research and arrangements for extra-mural work. In addition there are four appendices, including a glossary and list of papers already published and an index.

Much information is given on the direction

which medical research is taking in its attack on diseases hitherto intractable by orthodox methods. Of the industrial possibilities of atomic energy, some of the most interesting and valuable material is contained in the chapter recounting progress in fundamental research. While much of the chemical and physical investigation is specific to metals and compounds mainly encountered in atomic processes, some of the techniques devised have led to advances such as the accurate analytical detection of minute traces of various elements. Of special interest is the chapter on the metallurgy of uranium and its alloys, the investigation of which is of the highest importance for the development of better fissile fuel elements.

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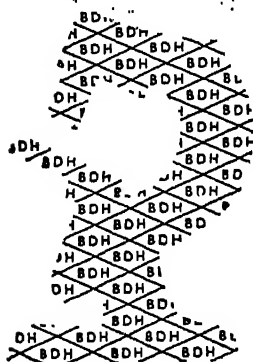
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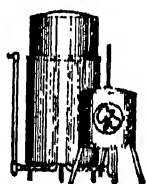
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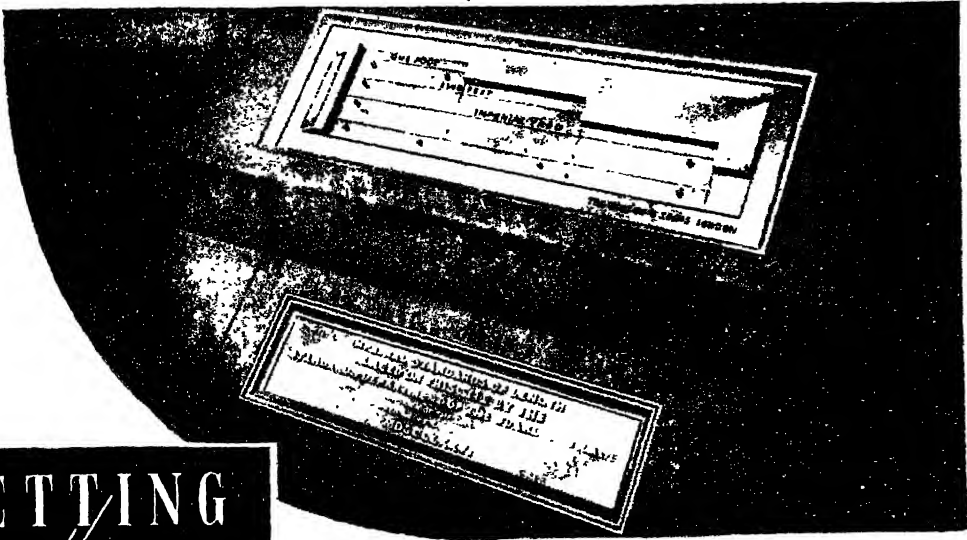
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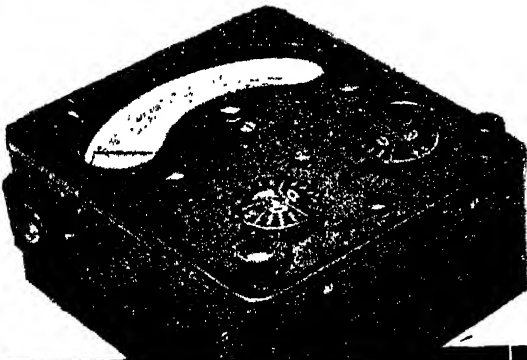
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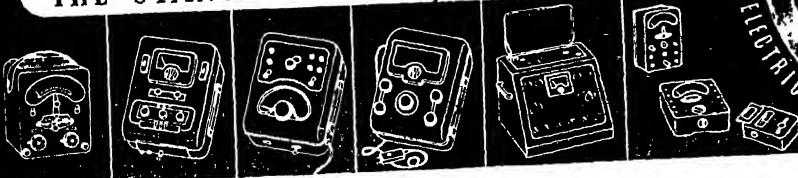


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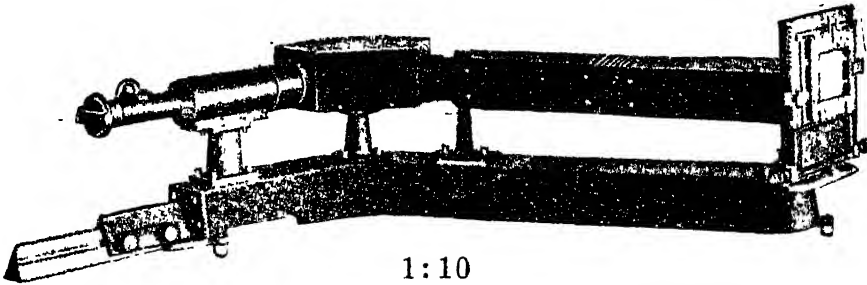
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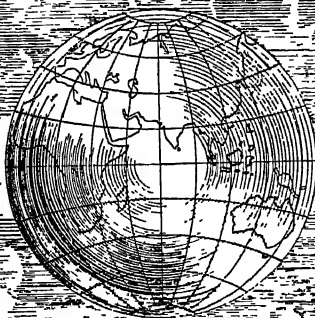
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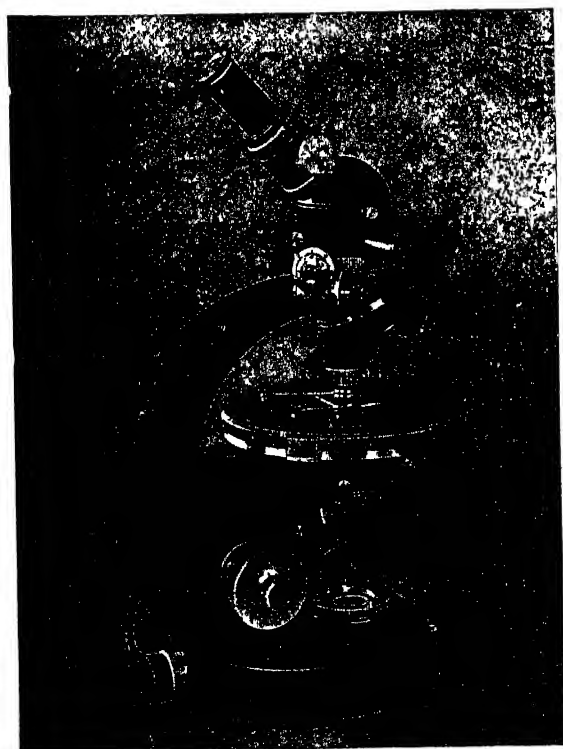
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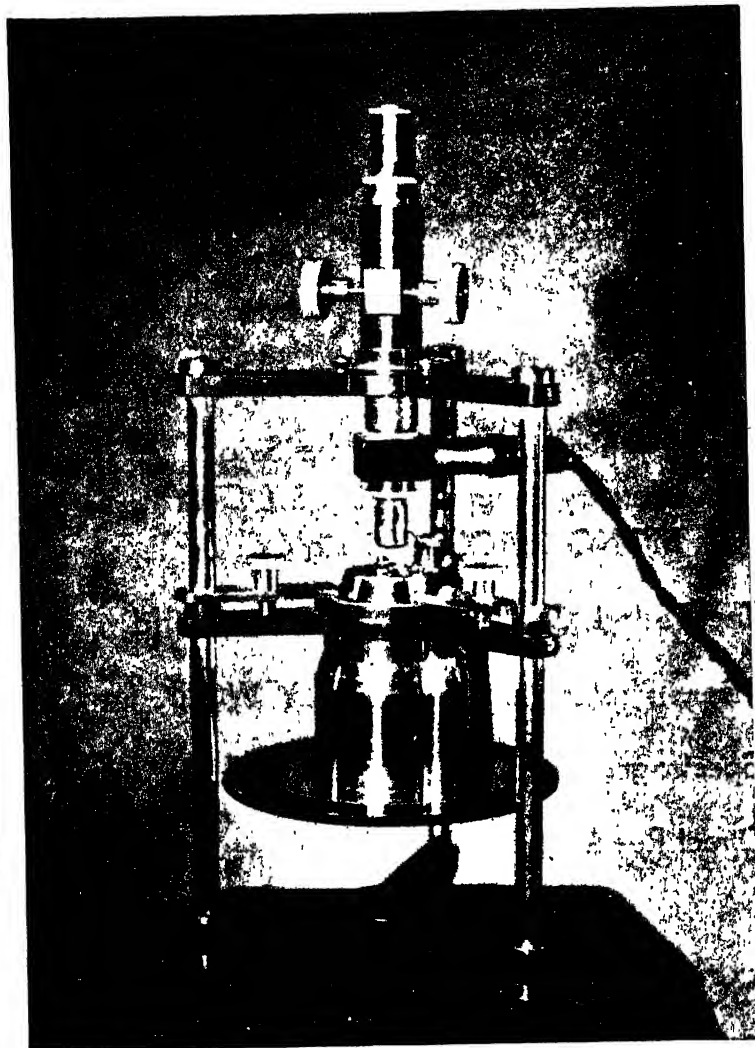
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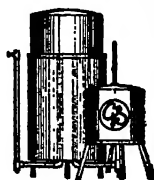
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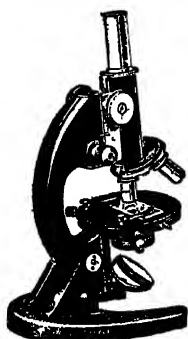


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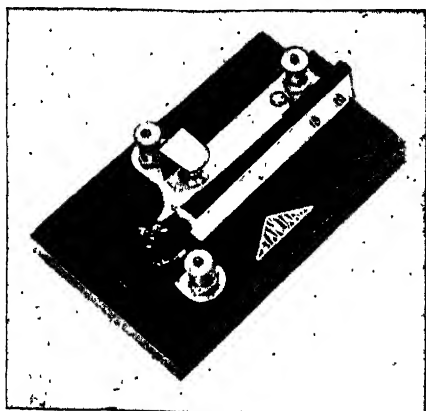
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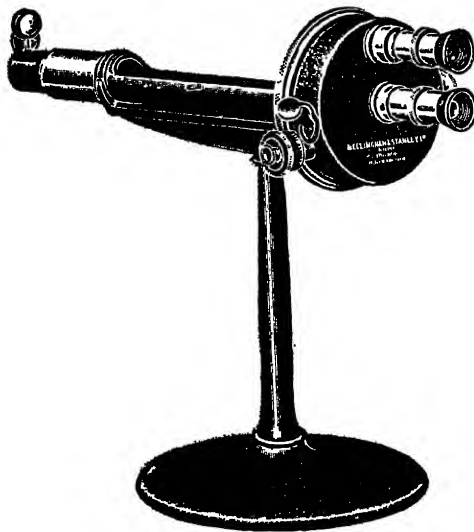
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# Current Science



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## CENTRAL ROAD RESEARCH INSTITUTE, DELHI

THE Central Road Research Institute, Delhi, the eighth in India's chain of National Laboratories, was formally declared open by Shri Pandit Jawaharlal Nehru, Prime Minister of India, on July 16th.

While the need for a Road Research Institute has been felt for some considerable time, the proposal to establish one is only of recent origin. The Conference of Chief Engineers of Provinces and States held at Nagpur in December 1943, proposed that India should have an additional 4 lakh miles of roads,\* including approximately 25,000 miles of national highways, 65,000 miles of provincial highways, 1,00,000 miles of major district roads and 1,50,000 miles of village roads. It was felt that if as a result of research, it is possible to reduce the cost of construction and maintenance by even one per cent. it will mean a saving in crores of rupees.

\* The total length of roads in India to-day is 3.5 lakh miles. The cost of constructing bituminous roads is about Rs. 30,000 per mile of road ten feet wide and Rs. 50,000 for a cement concrete road. A *kutch* road costs more than Rs. 5,000 a mile, besides heavy cost of maintenance.

The above proposal for a Road Research Institute took definite shape a year later when, at the initiative of Dr. S. S. Bhatnagar, then Director, Scientific and Industrial Research, and Mr. G. M. McKelvie, Consulting Engineer to the Government of India (Roads), the Industrial Research Planning Committee of the Council of Scientific and Industrial Research, recommended the establishment of a Central Research Institute covering all aspects of road research, such as building, equipment, maintenance, traffic and use. The Governing Body of the Council accepted this recommendation in 1945 and constituted a Road Research Planning and Advisory Committee for drawing up plans for the Research Institute. The Committee recommended that the Institute should be located at a place easily accessible to scientists and highway engineers from all parts of the country and that it should be near the Roads Organisation of the Ministry of Transport. These considerations led to the location of the Institute at Delhi, and a suitable site at the 7th mile of the Delhi-Mathura Road, about 31 acres in area, was secured as a gift from His Grace the Archbishop of Delhi-Simla. The site is advantageous since the Delhi-Mathura Road

carries a heavy traffic, which can be diverted over the Institute's test tracks for experimental purposes. The foundation-stone of the Institute was laid by the Hon'ble Shri N. Gopalaswamy Iyengar, the then Minister for Transport, Government of India, on September 6, 1950, and the construction of the Institute buildings commenced in February, 1951. Research work started concurrently in a temporary laboratory building constructed mostly from American pre-fabricated wood work.

The functions of the Central Road Research Institute are: fundamental research on the behaviour of materials used in road construction; correlation of test results on standard materials with those under practical conditions for enabling reliable estimates to be formed of the behaviour of road materials; tests on soils and study of soil mechanics; research connected with standards and specifications for roads and road-building plant machinery; design of instruments for road tests; studies on road characteristics under different conditions, incidence of accidents, road safety devices and road statistics; collaborative research projects with engineering colleges, research institutes and industrial concerns; technical advice and assistance; dissemination of results of road research by pamphlets, films, etc., for the benefit of road engineers and training of road technologists.

Special emphasis will be laid on low-cost, all-weather rural roads and their construction from locally available material. Test tracks will be laid in various parts of India and the results obtained in the Central Institute will be checked under service conditions prevailing in various localities.

The work of the Institute is to be organised under the following divisions: (1) Soils, (2) Flexible Pavements (Bituminous Materials), (3) Rigid Pavements (Mineral Materials), (4) Road, and (5) Traffic Engineering and Economic Research. Other sections of the Institute are: Workshop, Museum, Library and Intelligence, Photography and Drawing, Publications, Administration, Purchases and Stores.

Efficiency has been a primary consideration governing the design and layout of the Institute and architectural features have received due consideration. The total capital cost of the buildings, fittings and equipment is estimated at Rs. 29.64 lakhs. A sum of Rs. 19 lakhs has been spent on equipment and construction work so far.

Equipped on a scale which we have learnt to associate with the present Government of India, we indeed hope and trust that the new Institute would also contribute its legitimate share in furthering the progress and prosperity of our country.

---

## DON TO VOLGA

THE meeting of the waters of the Volga and the Don, through the newly-completed canal that links the two great rivers, fulfils an ancient dream of the Russian people. Over sixty miles long, the canal joins the river systems of the Black Sea Basin with the navigable rivers of the Volga and north-west basins, and links the White, Baltic and Caspian Seas with the Sea of Azov and the Black Sea.

The construction of the Tsimlyansk dam is a particularly fine piece of engineering achievement. Huge dams which are subjected to the pressure of an enormous mass of water are usually founded on rock. At Tsimlyansk, however, the dam raising the level of the Don to a height of over 85 feet and capable during the spring floods of letting through up to 4½ mil-

lion gallons of water per second had to be built on fine sand. Scientists and engineers boldly tackled this difficult task for the first time and solved it in a brilliant manner. Using enormous and intricate devices, special extinguishers, scoops, etc., the speed of the water has been cut down to a twenty-fifth, thus making it absolutely safe even for sand. To safeguard the dam from sub-soil waters, steel piles were driven into the ground by vibration.

The Volga Don construction which includes a ship canal, an electric power station and a huge irrigation system was completed in less than three years while the greater part of the work has been put through during the last twelve months.

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## THE CLASSIFICATION OF MAN

JEDRIC DOVER

CLASSIFICATIONS of human groups have an increasing social significance. Nevertheless, they continue to be affected by irregularities of interpretation and method, the latter being the subject of this note. Its shape has responded to consultations with Dr. S. L. Hora, Mr. A. Fraser Brunner and Mr. W. H. T. Tams, all of whom have particular experience in the fields from which apparent sanctions for confusing practices are sometimes drawn. I am also grateful to Dr. Kenneth Oakley for helpful discussion.

It would appear, to begin with, that the promotion of a useful classificatory science of man depends on the resolution of two seemingly different conceptions. The first assumes that it belongs to zoological taxonomy, the second that it is a matter for a special typology; and both views are complicated by a tendency amongst certain anthropologists to branch out into uncontrolled procedural directions. Annandale, observing this inclination more than thirty years ago,<sup>1</sup> warned those concerned that "Anthropology is fundamentally a branch of biology...perhaps the most complicated of all the branches of biology. To me it is inconceivable that a sound knowledge of anthropology can be obtained without a preliminary training in biological method." A few years later, Wood Jones<sup>2</sup> was still more precise: "The anthropologist should be a mammalogist who happens to be dealing with a particular mammalian type; and he should co-ordinate his procedure and weigh his hypotheses by the standards employed by workers in other mammalian groups."

But particulation has become so characteristic a feature of Western science in our generation that, in 1945, Simpson could justifiably complain<sup>3</sup> that "much of the work on primates has been done by students who had no experience in taxonomy and who were completely incompetent to enter the field." Moreover, he felt that "many studies of this order are covertly or overtly emotional"; and that it would perhaps "be better for the zoological taxonomist to set apart the family Hominidae and to exclude its nomenclature and classification from his studies." The alternative, especially for zoologists who recognise the rôle of their own neglect in the situation deplored by Dr. Simpson, is to struggle with the confusions of Hominid taxonomy, even though they become somewhat overwhelming when "racial" classifica-

tions are reached. The magnitude of this task is indicated by the following passage<sup>4</sup> from Trevor's recent abridgement on "race" in a standard work:

"Zoologically race is often equated with sub-species, although there is a tendency amongst some systematists to regard it as a more restricted category for intergrading populations of mammals and fishes. Most anthropologists would agree that all human beings who have lived during the past 10,000 years at least have belonged to a single but polymorphic<sup>5</sup> species—and most again in endeavouring to distinguish the various forms of this have considered, explicitly or otherwise, a hierarchy embracing three grades of different degrees of inclusiveness. The first and widest may be thought of as a constellation of races and has been designated 'variety', 'sub-species', 'primary group', 'major group', 'trunk', etc. The second and more restricted is in general termed simply 'race' and the third and narrowest 'sub-race'."

Dr. Trevor's own involvement in this peculiarly intricate synthesis is expressed<sup>6</sup> elsewhere in the comment that he is "in sympathy with some recent mammalogists, ornithologists and ichthyologists in regarding 'race' as a lesser category than sub-species or variety, a practice which Hubbs feels will come to be widely adopted in vertebrate zoology." Dr. Trevor has also said at meetings of the Royal Anthropological Institute and UNESCO that "variety" can be regarded as a higher category than sub-species.

Such taxonomic heresies could be abundantly elaborated from still more authoritative sources: it was not so long ago, for example, that a renowned anthropologist created the family *Homo-simidiæ* for the reception of *Australopithecus*. But, since they concern the concept of subspecies, it might be more useful to indicate the nature of its applications in zoological taxonomy. Its employment was first clarified as follows by Rothschild and Jordan<sup>7</sup> in their classic "Revision of the Sphingidae":

"Since Linné applied the term *varietas* to the forms which are not specifically different, we do not see any reason against the use of this very convenient word in the same sense for all the components of a species which differ from one another. We understand, therefore, under *variety* not a particular category of the components of a species, but employ the term for all the different members of a species indiscriminately. The different categories of varieties must receive special terms in a precise classification, and special formulæ must be employed for them in a precise nomenclature."

In accordance with this logic, they distinguished three kinds of varieties—individual, generatory and geographical—of which the *geographical variety* or *sub-species* “is the highest category of varieties.” They added that:

“As the term *varietas* includes also other varieties, it cannot be employed as such for the geographical variety except in a precise nomenclature; either a specifying attribute must be added (*var. geog.*), or an abbreviation of another term chosen (*subsp.*). But...we can do without the abbreviation...by simply mutually agreeing that a sub-species is designated by its name added to that of the species without any abbreviation before the sub-specific name.”

This formulation subsidised the growth of the trinomial system and its regulation by the International Commission on Zoological Nomenclature;<sup>8</sup> but its acceptance had a deeper basis than that of the authority of the Tring zoologists, or a codified agreement upon a systematic convenience. The environmental thinking influencing it has always been deeply rooted in biological philosophy; communities were regarded as potential species, and subspecies as communities well on the way to specific status. The vigour of this idea, during the years when the binomial system was being transformed, was emphasised by Tate Regan:<sup>9</sup>

“My own work on the structure, classification and geographical distribution of fishes, has led me to certain conclusions. I believe that the first step in the origin of a new species is not a change of structure, but the formation of a community, either through localization, geographical isolation, or habitual segregation.”

This opinion was emphasised by the brilliant researches of Annandale,<sup>10</sup> Hora<sup>11</sup> and others who believed that “evolution is no more than the adaptation of organisms to environment” (Hora); and the advance of genetics has by no means eliminated it.<sup>12</sup> Supporting experimental evidence was also available, which found a new but neglected significance in the remarkable studies of the American Negro cytologist, E. E. Just.<sup>13</sup> He offered the first major proofs for placing “the determination of characters in the cytoplasmic reactions”; and the independent continuation of similar enquiries in Soviet Russia<sup>14</sup> will only be ignored by those whose scientific vision has become clouded by the “cold war”.

Yet the environmental view did no more than create a part of the philosophical atmosphere for the trinomial system and its attendant standards. The functional stimuli came, nat-

urally from the actual materials under analysis—and not the least of these arose from the morphological phenomenon of isomerism characteristic of animals in general and the higher vertebrates in particular. These repetitions of similar parts narrow down from the supra-specific unities to the species level; and, by confounding structural diagnoses, compel reference to geographic or ecologic criteria. In botany, on the other hand, the task is somewhat simpler. Anisomerism (or marked changes of emphasis on a fundamental pattern) amongst the flowering plants facilitates the morphological separation of nearly related species and infra-specific categories.

It often happens that the extension of a system urges further extensions, but taxonomists have resisted the creation of a quadrinomial nomenclature, partly because it would provide a warranty for multinomial exercises that would soon reduce systematics to an unworkable mass of names. Compliance with the Commission's austerities is accordingly almost universal in zoology, even when lesser varietal names are logically employed for bionomic or other purposes. Calman's statement<sup>15</sup> on this point is the accepted law: “The only infra-specific category which is recognised by the International Commission on Zoological Nomenclature is the *subspecies*.”

Certain conclusions of basic importance to “racial anthropology” follow inevitably. They are that (1) there can be no varietal category higher than that of subspecies, which is “the highest category of varieties”; (2) a necessary corollary of the determination of a subspecies is the definition of its territory, whether geographic or otherwise; (3) the admission of contemporary subspecies of *Homo sapiens* would concede their potentialities as species and would actually promote “doctors' disagreements” (of profound social significance) about their rank;<sup>16</sup> (4) the acceptance of subspecies or races in man must restore the correlation between race and culture which most liberal scholars now deny; and (5) the term “race” has no currency in zoology, except as a *colloquial* synonym for subspecies: the latest compendium of biological terms<sup>17</sup> does not even include it.

The procedures involved in separating subspecies support these conclusions. They have been exhaustively covered by the works of Huxley<sup>18</sup> and Mayr,<sup>19</sup> but it might be useful to quote Lack,<sup>20</sup> who incidentally provides a typical example of the permissible use of the word “race”:

"Subspecies (of birds), as the term implies, differ from each other to a smaller extent than do full species, the differences chiefly involving shade of plumage and size. But a more important criterion is that of geographical distribution. Subspecies of the same species always breed in separate geographical regions, and where their respective breeding zones adjoin, they often interbreed freely and intergrade in characters. On the other hand, two forms which breed in the same region without normally interbreeding are always classified as separate species, however similar they may be to each other in appearance.... Difficulty occurs chiefly in regard to related forms which occupy separate geographical regions, like subspecies, but which differ from each other more markedly than is usual among races of the same species."

The views of the American ichthyologist Carl L. Hubbs,<sup>21</sup> to which reference has been made, remain to be considered in this connection. The literature provides no indication of the popularity claimed for them; and it is noteworthy that, in the reviewing section edited by Dr. Hubbs himself for *The American Naturalist*, the well-known ornithologist Alden H. Miller insists<sup>22</sup> that Hubbs' use of "the term 'race' for minor categories should not be pressed upon other workers who for long have used 'race' and subspecies' as synonyms." It need hardly be added that Dr. Hubbs makes no claim for altering or extending the rules governing the trinomial system.

The fact that zoologists know forms (mostly host-varieties) that can be called "biological races" or "ecological races" does not justify racial definitions of categories below that of subspecies, whether in man or otherwise. Anthropologists who seek proofs by analogy in these circumstances usually lack the working experience of taxonomy which inhibits such enthusiasm. For the discussion of biologically isolated populations of a species in *qualified* terms of "race" has a logical pattern in that it stresses environmental separation just as subspecies or "geographical race" does; and, as the "accepted meaning of subspecies" includes host-variations,<sup>23</sup> such categories are equally synonymous with subspecies when the forms included in them are adequately established. Moreover, where definitions of particular populations of subspecies are necessary, other terms are available which avoid the confusions of "race".

It should be noted, too, that the unfortunate use of the term "sociological race", for distinguishing human groups that are "socially supposed" to be racially different, derives no

sanction from ecological usage as is often supposed: it is indeed difficult to visualise more in the parallel than a resemblance of form and sound. Biological races are the products of interaction with relatively stable habitats beyond their control, but human groups cannot respond racially to the temporary influence of the most stable social situations. Therefore, "sociological race" is an incompatible proposition which cannot be accepted within the same body of knowledge. It would actually be impossible to incorporate a statement carrying the unalterably biological meaning of innate qualities (*race*), and its negation (*sociological*), in the precise language of an axiomatic system.<sup>24</sup>

A word now about the view that the classification of recent mankind is not the business of zoological taxonomy. It postulates no more than simple "lumping", augmented perhaps by typological discriminations, and its backgrounds are evident in the work of all cautious zoologists. They believe, as Darwin did, that certain cases, "precisely like that of Man", require the grouping of "all the forms which graduate into one another, under a single species"; for no one has the "right to give names to objects which they cannot define."

This diffidence lies behind the virtual abandonment of the classification of mankind by zoologists to-day. Their attitudes are typified by the work of Simpson, who regards the Hominidae as a monogeneric family, except for the possible inclusion of *Pithecanthropus* and *Eoanthropus*; and of Huxley and Haddon,<sup>25</sup> who reject the racial ideology and offer the neutral term "ethnic group" as an instrument for classifying living men. The underlying assumptions seem to be that, "since man has control over nature, the question of human 'races' must be considered on different bases to those we are accustomed to in taxonomy." In fact, according to ordinary zoological standards, there are no human races.

This is the opinion of Dr. Sunder Lal Hora in commenting upon the first outline of this paper. He attached some remarks by his colleague Dr. B. Biswas, an ornithologist, with which he was in "complete agreement". They are worth quoting:

"The classification of living mankind on the same principles as those regulating the taxonomy of other animal forms would be a futile attempt, because the criteria for grouping animals below species are practically indiscernible in human groups. For example, separate breeding territories—the chief criterion for geogra-

physical subspecies of animals—are not a characteristic of man, at least in the 'civilised' state. Mass movements and migrations, sometimes involving whole populations, have transformed *Homo sapiens* into a species consisting only of intergrades, with mere traces here and there of the original subspecies, if there were any. For these reasons, it is my contention that...if the human species is to be classified at all, it should be along the lines of the classification of the different breeds of domesticated animals. And different terminologies, to avoid the use of such terms as 'race', would, of course, have to be devised with the help of systematists in biology."

The growth of a similar approach in the social sciences has found much nourishment in recent years, particularly from outstanding cultural anthropologists such as Melville J. Herskovits.<sup>26</sup> Its practice would require a reorientation of the scope and methods of anthropology, which would hasten the reabsorption of physical anthropology by zoology, just as other "special sciences", created by new techniques, opportunities and pressures (microscopy and microtomy, for instance), have lost the status they once possessed.

It must be expected that such a reorientation will be contested, especially when vested interests are involved, but it is not beyond the capacity for academic adjustment. In America and elsewhere, as Hager reports,<sup>27</sup> "this shift in emphasis...has already begun...and there has been a steady decline in the publication of descriptive racial studies, studies of 'race mixture', constitutional typing and anthropometry." Indeed, the process has gone so far that, at several major American universities, the courses in physical anthropology "have been entirely re-structured: many no longer bear that name." These changes, it should be added, are socially based; they are much more influenced than is generally recognised by the falsification of racial thinking<sup>28</sup> pioneered by Huxley and Haddon; and they are encouraged by the absence of any demand for a taxonomic background to cultural anthropology.

It would seem, then, that anthropology can function without a foundation of zoological taxonomy. But the organisation of every science depends on classification; and, if anthropology is to set up typological conventions of its own, the separation from taxonomy cannot be absolute: the systematics of extinct forms and the typology of living men must necessarily complement each other. For the definition of modern man is continuously affected by new discoveries and interpretations concerning his predecessors—and this know-

ledge must remain grounded in taxonomy. Nor can any scientific discipline ignore the elementary principle of unity of usage: common concepts, terms and definitions must keep their interchangeability; new ones should be new and logically related; and borrowings should be borrowed whole and without confusing redefinitions by inventive reformers.

It follows that any reasonable classification of man must depend upon confident familiarity with the theory and practice of zoological taxonomy; and, for this reason, Huxley's *cline* typology might offer a workable method—at least to those who believe that the types of mankind can be clearly differentiated. But, whatever the method, it should have the flexibility which has allowed taxonomy to contain extremes of "splitting" and "lumping" without damage to its structure.

Finally, the indications are that individual refinements of the classificatory study of man, particularly when they follow the neo-classical rituals of limited metric analyses or express personal idiosyncracies, are unlikely to produce more than further controversy. Revised approaches and wide co-operation, sufficiently rooted in objective realities to resist the pressure groups which have vitiated recent pronouncements on "race", are now imperative. And Indian zoologists and anthropologists are uniquely circumstanced, since they are little impeded by Western racial ideologies, for promoting the new directions that are necessary. They can provide, in these ways, another substantial contribution from India to the welfare and wisdom of humanity.

- 
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  2. Wood Jones, F., *Man*, 1930, 30, 61.
  3. Simpson, G. G., *Bull. Amer. Mus. Nat. Hist.*, 1945, 85, 181 & 198.
  4. Trevor, J. C., *Chambers' Encyclopædia* (Newnes, London), 1950, 11, 428.
  5. Dr. Trevor's dictionary usage of the word "polymorphic" reveals that he is unaware that in zoology a "polymorphic species" is one in which there are set kinds of individuals associated with biological phenomena—e.g., the different females of mimetic butterflies, *H. sapiens* is a polytypic species.
  6. Trevor J. C., *Journ. Roy. Anthropol. Inst.*, 1950, 77, 63n.
  7. Lord Rothschild and Jordan, K., *Nov. Zool.*, 1903, 9 (Suppl.), 43. Also Tams, W. H. T., *Entom. Rec.*, 1927, 39, 25.
  8. Schenk, E. T. and McMasters, J. H., *Procedure in Taxonomy* (Stanford Univ. Press, California), 1936.
  9. Regan, C. T., *Ann. Mag. Nat. Hist.*, 1923, 12 (9), 167.
  10. Annandale, N., *Proc. Roy. Soc.*, 1924, 96B, 76.
  11. Hora, S. L., *Phil. Trans. Roy. Soc.*, 1930, 218 B, 172.
  12. Tokens of its contemporary persistence will be

found in *Lectures on the Development of Taxonomy*, edited by G. R. de Beir (Linnæan Society of London, 1950) and S. L. Hora's Address on Adaptation and Evolution in *Proc. National Inst. Sci. India*, 1952, **18**, 161-70. 13. Just, E. E., *Amer. Nat.*, 1936, **70**, 267-312; and *The Biology of the Cell Surface* (Blakiston, Philadelphia), 1939. Also F. Wood Jones, *Proc. Linn. Soc. Lond.*, 1945, **157**, 11-14. 14. Morton, A. G., *Soviet Genetics* (Lawrence and Wishart, London), 1951. 15. Calman, W. T., *The Classification of Animals* (Methuen's Biological Monographs), 1949. 16. Dobzhansky, T., *Amer. Journ. Phys. Anthropol.*, (n.s.), 1944, **2**, 251-62, and Gates, R. R., *ibid.*, 279-92. "A subspecies," says Mr. Tams in this connexion, "is a species of which we know the geographical history." 17. Abercrombie, M., Hickman, C. J. and Johnson, M. L., *A Dictionary of Biology* (Penguin Reference Books, London), 1951. 18. Huxley, J. S., *et al.*, *The New Systematics* (Oxford Univ. Press), 1940. 19. Mayr, E., *Systematics and the Origin*

*of Species* (Columbia Univ. Press, New York), 1942. 20. Lack, D., *Darwin's Finches* (Cambridge Univ. Press), 1947. 21. Hubbs, C. L., *Ann. N. Y. Acad. Sci.*, 1943, **44**, 111. 22. Miller, A. H., *Amer. Nat.*, 1943, **77**, 552. 23. Bethune-Baker, G. T., *et al.*, *Proc. Entom. Soc. Lond.*, 1925, lvR. 24. Kaufmann, F., *Methodology of the Social Sciences* (New York), 1944; and Woodger, J. H., *The Axiomatic Method in Biology* (Cambridge Univ. Press), 1937. 25. Huxley, J. S. and Haddon, A. C., *We Europeans* (Cape, London), 1935. In the U.S. particular credit for advancing the views of Huxley and Haddon belongs to M. F. Ashley Montagu (for example, see *Psychiatry*, 1945, **8**, 27-33). 26. Herskovits, M. J., *Man and His Works* (Knopf, New York), 1948. 27. Hager, D. M., *Man*, 1951, **51**, 54. 28. Dover, C., *Ibid.*, 1951, **51**, 55.

*Note*.—An essential statement by S. L. Hora on the taxonomic assessment of a species will be found in *Journ. Zool. Soc. India*, 1949, **1**, 91-100.

## PAPYROGRAPHIC STUDIES ON PEPTIDES

BHARATHI BHEEMESWAR AND MOTNAHALLI SREENIVASAYA

(Indian Institute of Science, Bangalore)

RANGA RAO AND SREENIVASAYA<sup>1</sup> have shown that the non-protein nitrogen (N.P.N.) fraction of the body fluids of the lac insect (*Laccifer lacca*) contains simple crystalline peptides, non-precipitable by trichloroacetic acid. Milks obtained from different types of mammals<sup>2</sup> and pulses<sup>3</sup> have also been shown to be associated with high percentages of N.P.N. whose presence therein is believed to be responsible for the ease with which they are assimilated. Peptides are widely distributed and are intimately associated with all active and proliferating tissues—both plant and animal—and owe their existence to the continual breakdown and resynthesis of proteins which characterise living tissues and body fluids. Particularly rich is their concentration in the body fluids of animals and the saps of plants, since their role is one of providing tissues with an easily mobilisable source of nitrogen exceptionally adaptable for rapid tissue formation.

Special physiological significance is attached to some of the peptides; they have been found to act as co-enzymes or activators, essential growth factors or antibiotics. Glutathione,<sup>4,5</sup> the well-known tripeptide, for example, is a co-enzyme of methyl glyoxylase, an activator of papain<sup>6</sup> and an effective stabiliser of ascorbic acid.<sup>7</sup> Its unfailing presence in actively proliferating tissues is suggestive of the suspicion that glutathione may have other functions

yet undiscovered. More recently, glutathione,  $\gamma$ -glutamyl, and acyl peptides have been shown to participate in the enzymatic transpeptidase reactions.<sup>8,9</sup> Strepogenin<sup>10</sup> which was discovered by Woolley in 1944, and which has been shown to be present in most of the proteins of high biological value,<sup>11</sup> stimulates the growth of certain bacteria. Subsequently other investigators have sought to isolate other peptides from enzymatic digests of proteins and determine their growth-promoting potency. Ågren<sup>12</sup> has found significant increases in the growth of children fed with peptides resistant to the action of catheptic enzymes. Dunn<sup>13</sup> has recorded the stimulating effect of partially hydrolysed digests of casein and of the albumin of bovine plasma, on *L. casei* resulting in a higher rate of acid production. It was shown that the organism utilised the essential amino acid more readily when provided in a peptide-bound form. Simonds and Fruton<sup>14</sup> have also observed that a mutant of *E. coli* utilises for growth peptides of proline at a faster rate than proline. A genus of "alcaligenes" utilised leucine peptides only when leucine was present at the amino end of the unsubstituted peptide.

Another entirely new group of peptides, which has received considerable attention, is derived from the culture filtrates of bacteria, e.g., polymyxins, gramicidin, tyrocidine and Tyrothricin.<sup>15</sup> The structure of these antibio-

tically active peptides have been thoroughly elucidated and in the accomplishment of this task, papyrographic<sup>16</sup> and column chromatographic methods<sup>17,18,19</sup> have been extensively employed.

Fractionation, isolation and characterisation of such peptides present in enzymatic digests of proteins, body fluids, bacterial filtrates, etc., have presented problems difficult to solve but the recent techniques of papyrography and column chromatography promise to provide the means of achieving the objective with exceptional ease and elegance. Stein and Moore,<sup>17,18,19</sup> have extended the use of starch columns for a fractionation of the protein hydrolysates and more recently, Ottesen and Villet<sup>20</sup> have employed starch column chromatography for fractionating the peptides released during the enzymatic transformation of ovalbumin to plakalbumin. Papyrographic technique has been employed by Jones<sup>21</sup> and Cutch, *et al.*,<sup>22</sup> in a study of the separation and amino acid make-up of the polymyxins.

The present study is devoted to a determination of the Rf values of some nine peptides and three chloracetyl derivatives of amino acids employing two solvent systems and describes special methods for the location and characterisation of certain aromatic amino acid peptides. These methods have been developed mainly with the objects of applying them to a study of the nitrogenous constituents associated with hæmolymph and the silk gland of the silkworm.

#### Experimental

The synthetic peptides employed in our studies were all obtained from Hoffman La Roche (Switzerland). Aliquots of 1  $\mu$ l. of a 1.0 per cent. aqueous solution of the peptide were employed for spotting along a line drawn 2 cm. above the edge of a rectangular sheet (28 cm.  $\times$  22 cm.) of Whatman No. 1 filter sheet. Spacing the spots 2 cm. apart, 13-14 spots could be accommodated on the sheet for a one-dimensional development of the papyrogram. The "spotted" sheet was rolled into a cylinder, which was then left in the developing chamber containing the solvent system, butanol-acetic acid-water (10:2.5:10) or pyridine-water (4:1), for a couple of hours with a view to have the cylinder equilibrated with the vapour phase of solvent system. At the end of this period, the cylinder was carefully lowered into the flat-bottomed dish containing the developing solvent. The development of the papyrogram, which was conducted at the room tem-

perature (24° C.) takes 5-6 hours. The cylinder was then removed from the chamber, unfolded and the sheet air dried.

First an ultra-violet print (U.V.P.) was taken by the method of Markham and Smith;<sup>23,24</sup> then the paper was sprayed with 0.2 per cent. solution of ninhydrin in water-saturated butanol. The paper was then air dried and after making observations, the paper was further dried in a hot-air-oven (80° C.) for 10 minutes and again examined for the ninhydrin positive spots. The Rf values of amino acid derivatives and the peptides have been determined in the usual way, making use of both the ninhydrin positive and the ultra-violet opaque spots obtained in the U.V. print in the case of some of the "aromatic" peptides (see Table I). Observations made during the period of drying of the ninhydrin sprayed papyrogram, showed that a few of the spots appeared earlier than others. For example, alanyl glycine, glycy glycine and diglycyl glycine were among the first to show the colours. The colours developed by glycy glycine and di-glycyl glycine to begin with, are yellow which, later develops into a brownish pink.

TABLE I

Peptides	Butanol water	Ultra-violet print	Pyridine water
Alanylglycine ..	0.33	..	0.4
Glycylglycine ..	0.26	..	0.25
Diglycylglycine ..	0.22	..	0.30
Leucylglycine ..	0.60	..	0.63
Leucylglycylglycine ..	0.52	..	0.68
Glycyl-tryptophane ..	0.54	0.54	0.60
Glycylleucine ..	0.66	..	0.55
Glycyltyrosine ..	0.46	0.46	0.65
Glutathione ..	0.19	..	0.13
Chloracetyltyrosine ..	..	0.97	..
Chloracetyltryptophane ..	..	0.98	..
Chloracetylleucine ..	..	..	..

It will be seen (Table I) that the Rf values of the peptides obtained with the two solvent systems do not overlap; they are sufficiently wide apart to permit discrete separations of peptides in mixtures. Further, the individual spots of the peptides are smaller and more compact, a circumstance which adds to the efficiency of discrete separations and effective locations of spots either by the U.V.P. or the ninhydrin method. The U.V. printing of the pyridine-water developed papyrogram, is not possible in view of the fact that the residual pyridine which is difficult to eliminate from the



papyrogram itself absorbs the ultra-violet radiation.

Of the peptides and amino acid derivatives which have been studied, the chloracetyl derivatives of leucine, tryptophane and tyrosine do not react with ninhydrin, since they have no free amino group. The location of two of the "aromatic" amino acid derivatives on the papyrogram was carried out by the U.V.P. method while the location of the leucine derivative is not possible. The spots of the aromatic amino acid derivatives and peptides could also be detected by reacting the papyrogram with dimethyl *p*-aminobenzaldehyde for the characterisation of the tryptophane peptide which yields a violet spot while the tyrosine derivative could be located by the brick-red colour developed with Millon's reagent.

The peptide spots were individually excised from the papyrogram, extracted with hot water by means of a microfilter, and the extracted peptide concentrated to a small volume in vacuum over silica gel. The solution was then hydrolysed in a sealed tube with 5 N hydrochloric acid for 2.5 hours at 100° C. The hydrolysate was freed of its HCl and concentrated by evaporating the solution in vacuum over caustic potash and sulphuric acid placed separately in a desiccator. The hydrolysate, when spotted and developed, gives the constituent amino acids of the peptide.

It will be seen from the preceding discussion that papyrographic methods when coupled with U.V.P. and micro-hydrolysis techniques, are useful for a separation and characterisation of the peptides and amino acids when they occur

in mixtures as they do in enzymatic digests of proteins, plant saps, body fluids and tissue extracts. These methods, together with two-dimensional papyrographic methods, are being extended to a study of the hæmolymph and the silk gland of the silkworm.

Our sincere thanks are due to Professor M. S. Thacker, Director, Indian Institute of Science, for his kind interest.

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## POPULARISATION OF SCIENCE

THE problem of popularizing scientific knowledge, that is to say, its dissemination amongst non-specialists, has to-day become a very important and very delicate problem: very important because it is essential that public opinion at all levels should be able to understand the scope of scientific progress, its intellectual value, and the tremendous repercussions which

it can have on the future life of all peoples and on the evolution of their civilisation; very delicate because scientific knowledge is becoming more extensive and more complex each day, so that it is very difficult to make it comprehensible for the general public without an unfortunate distortion of some of its aspects.

PROF. LOUIS DE BROGLIE.

## CENTRAL AID FOR FUNDAMENTAL RESEARCH

WITH a view to promoting fundamental research in Universities and other educational centres, the Central Government have decided to set apart a small amount for giving grant-in-aid to individual research workers who have been experiencing difficulties in the furtherance of their work. The grants will be made available for the purchase of special apparatus

or for its construction, for consumables, stores, books, etc. Applications are to be addressed to the Secretary, Ministry of Education (Technical Education Division), giving full particulars concerning the lines of research on which they are engaged, the type of assistance required and any other relevant information useful for consideration of the cases.

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ANOMALOUS EFFECTIVE  
ROTATIONAL TEMPERATURE OF  
HgH BANDS

THE emission bands of HgH, particularly those belonging to the transition  $A^2\Pi \rightarrow X^2\Sigma$  are interesting from more than one point of view, such as predissociation by rotation,<sup>1</sup> nuclear isotope effect,<sup>2</sup> abnormal effective rotation temperature,<sup>3</sup> etc. It has been found that the intensity distribution among the rotational lines of the bands belonging to the above transition does not admit the possibility of evaluating the effective rotational temperature because of the fact that the plot of  $\log(I/i)$  against  $J'(J'+1)$ , does not yield a straight line.<sup>3</sup> Restricting oneself to low  $J'$  values where the plot is a straight line, effective rotational temperatures of the order 900° K have been deduced. Such a value obtains not only when the bands are produced by a discharge through mercury vapour and hydrogen<sup>4</sup> employing a current of 0.6 to 50 m.amps., and a voltage of 400 but also when the bands are produced by sensitised fluorescence at room temperature.<sup>5,6</sup>

As the bands could be produced easily by sending a high frequency discharge through a tube containing sufficiently large quantities of mercury and hydrogen using external electrodes an investigation was made of the abnormality of rotation temperature under these discharge conditions.

Using a low power oscillator (10-12 watts) built on a modified Hartley circuit, it was found that no discharge occurred unless the tube was heated to a temperature of about 230° C. Accordingly the discharge tube was kept in a sufficiently long electrical furnace whose temperature could be regulated up to a maximum of about 350° C. The bands were best developed when the temperature of the furnace was between 230° and 245° C. and the spectra at temperatures 231° and 237° C. were photographed using a three-prism glass spectrograph.

From a visual estimation of the relative intensities of the rotational lines of the bands 4520 Å (0-3) and 4394 Å (0-2) belonging to the transition  $2\Pi_{1/2} \rightarrow 2\Sigma$  their effective rotation tem-

perature was found to be roughly 1100° K for the former and 1000° K for the latter. The plot of  $\log(I/i)$  against  $J'(J'+1)$  deviated considerably from a straight line for values of  $J'$  greater than 5 and the above temperatures were obtained by neglecting such points. In this respect these results are similar to those obtained in the other modes of excitation, and point to the fact that the distribution of the molecules in the excited rotational states is not Maxwellian. This conclusion was corroborated by measuring the relative intensities,  $I_1, I_2, I_3$ , at the three temperatures 231° C. ( $T_1$ ), 234° C. ( $T_2$ ), 237° C. ( $T_3$ ) respectively, of several rotational lines, of the (0-0) band at 4,017 Å belonging to the transition  $2\Pi_{1/2} \rightarrow 2\Sigma$ . The following values were found for the factor  $\log(I_1/I_2)/\log(I_1/I_3)$  in the case of a number of lines, selected at random: 1.314, 1.296, 0.399, 0.323, 0.660, 0.720, 0.960, 0.420. If the distribution was Maxwellian the values should all be the same and equal to  $T_3(T_1 - T_2)/T_2(T_1 - T_3)$  which has a value of 0.653.

I wish to thank Dr. R. K. Asundi for guidance in this work.

RAMACHANDRA K. ASUNDI (JR.).

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Banaras Hindu University,  
May 28, 1952.

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### THE TERTIARY BEDS OF VINJHAN- MIANI AREA, SOUTH-WESTERN CUTCH, INDIA

VERY little has been added to our knowledge of the Tertiary rocks of Cutch since the work of Wynne,<sup>1</sup> Vredenburg,<sup>2</sup> and Nuttall,<sup>3</sup> and a classification of these beds on the basis of the contained foraminifers has not yet been attempted. I visited parts of Cutch in 1949 and made a detailed study of the Tertiary rocks exposed in the neighbourhood of Vinjhan (23° 6' : 69° 2') and Miani (23° 7' : 69° 6') area in the south-western part of the island. The rocks are well exposed and a continuous section of the strata, which are gently folded can be followed in the Kanakavati river, which tra-

verses this area. The sequence of beds with the contained fossils is as follows:

Bed (5). Coarse-grained sandstones and shales with intercalated bands of lime-stones several hundred feet thick. A few fossils were noticed in the lower calcareous band, which has yielded *Balanus* and smaller foraminifers. These have not been examined in detail. The bed may be equivalent of a part of the Manchhars (Middle Miocene to Pliocene) of the Western Pakistan.

Bed (4). The bed is composed of shales and is about 900 feet thick. The bed contains throughout *Taberina malabarica* (= *Orbiculina malabarica*). The upper 30 feet of this bed is rich in molluscs and the following have been identified: *Turbinella mekranica*, *Strombus mekranicus*, *Venus (Omphalocladrum) mekranica*, *Dosinia subpenicillata*. All these are found in the Talar stage (Pontian) of Baluchistan. These molluscs have not been noticed in the underlying strata, which has yielded the following foraminifers: *Taberina malabarica*, *Miogypsina* sp., *Miogypsinoidea* sp., *Miolepidocyclina* sp., *Austrotrillina howchini*. Along with the above foraminifers *Ostrea (Lopha) virleti* and *Ostrea digitata* are also found. No Lepidocyclines have been noticed in this bed. *Ostrea (Lopha) virleti* and *Ostrea digitata* are found in the Talar stage (Pontian) of Baluchistan and Akaukaung bed (Vindobonian) of Burma. The bed is post-Gaj in age and the presence of *Miogypsina* and *Miogypsinoidea* indicates that it is not younger than the Middle Miocene (Vindobonian) and it may be, therefore, correlated with the Vindobonian (Middle Miocene).

Bed (3). Loose and coarse-grained sandstones showing current bedding, a little more than 200 feet in thickness. No mega-fossils have been procured from this horizon. The beds are provisionally referred to the Nari Series (Oligocene).

Bed (2). This bed is composed of limestones and marls of about 500 feet in thickness. The following fossils have been identified: *Nummulites acutus*, *Nummulites obtusus*, *Nummulites stamineus*, *Nummulites maculatus*, *Alveolina elliptica*, *Dictyoconoides cooki*, *Discocyclina dispansa*, *Discocyclina javana* var. *indica*, *Discocyclina undulata*, *Discocyclina sowberbyi*, *Hantkenina* sp., *Linderina* sp., *Halkyardia* sp. The contained fauna indicates lower part of Middle Kirthar (Lutetian) age of these beds.

Bed (1). Shales about 50 feet in thickness, which appear to be unfossiliferous. Wynne called these sub-nummulitic group and this

may be of Laki age. Below this are the Deccan Traps.

The Upper Kirthars and the equivalents of the *Pellatospira* bed (Priabonian) of Surat<sup>4</sup> are not present in this area.

Among palæontological results obtained mention may be made of the discovery of the foraminiferal genera *Halkyardia*, *Linderina* and *Hantkenina* from the Middle Kirthars of this area. These fossils are being recorded for the first time from India, and it may be noted that *Hantkenina* is confined to the Eocene and has a wide geographical distribution. Species of this genus are regarded as index fossils for different subdivisions of the Eocene. *Taberina malabarica* (= *Orbiculina malabarica*) is also being recorded for the first time from Cutch, and appear to be of Vindobonian age. Henson<sup>5</sup> has recently discovered *Taberina malabarica* from the Lower Fars limestones (Middle Miocene) of the Middle East.

I am grateful to Prof. S. R. N. Rao for guidance and encouragement in this work.

Dept. of Geology,  
Lucknow University,  
Lucknow,  
March 25, 1952.

B. S. TEWARI.

2. Wynne, *Mem. Geol. Surv. Ind.*, 1872, 9. 2. Vredenburg, *Rec. Geol. Surv. Ind.*, 1908, 36, 239. 3. Nuttall, *Ibid.*, 1926, 59, 115-64. 4. Rao, *Journ. Mys. Univ.*, 1941, 2, 5-17. 5. Henson, *Middle Eastern Tert. Penetroplida*, 1950, 50.

#### EFFECT OF SOAP CONCENTRATION ON THE INTERFACIAL TENSION OF SOME ALIPHATIC ALCOHOLS AND ESTERS

It is generally observed that the interfacial tension at the oil-water interface decreases with the increasing concentration of soaps, oleates, stearates, etc., in water, till a limiting value is reached. This may be accounted for on the basis of the mono-molecular layer theory of adsorption of fatty acid radical on the interface of the oil droplet.

In our work it has been, however, noticed that the interfacial tension for some liquids like hexyl and octyl alcohols, and propyl, butyl, amyl acetates, etc., is initially found to increase with increasing soap concentrations for dilute solutions, followed by usual decrease in interfacial tension with further increase in soap concentration. With saponin, however, such a behaviour as observed with dilute soap solutions, is not observed.

The interfacial tension of liquids against aqueous phase in presence of soaps was measured by the drop number method using a microsyringe (Burrows and Welcome) which gives the volume of a single drop with an accuracy of 0.0004 c.c. The final values for the interfacial tension were obtained by applying Harkin's Correction Factor for the size of the drop.<sup>1</sup> The effect of soap concentrations on the interfacial tensions of sec. octyl alcohol and normal butyl acetate against sodium oleate solutions is indicated in Fig. 1.

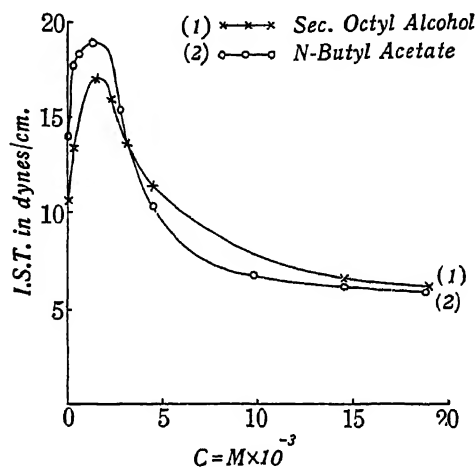


FIG. 1

The interesting behaviour of the liquids may be explained on the basis of the reversal of electrical double layer at the oil-water interface and further that these liquids have a ring structure postulated by Smith and McReynolds.<sup>2</sup> They have stated that the data of esterification, saponification, dissociation constants, irregularities in optical rotatory power and other anomalies may be explained on the basis of ring structure through hydrogen bond. The formation of ring structure has been also postulated by Evans and others.<sup>3</sup> This type of ring must, by its very nature, be quite unstable. The details of the experimental results and the discussion will be published elsewhere. Further work along this line on different alcohols, esters, ketons, etc., is also in progress.

Chemistry Dept.,  
M. T. B. College,  
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February 5, 1952.

(Miss) H. J. KAZI.  
C. M. DESAI.

1. Harkins, *J. Am. Chem. Soc.*, 1919, 41, 499. 2. Smith and McReynolds, *Ibid.*, 1939, 1963. 3. Evans et al., *J. Chem. Soc.*, 1938, 1434.

# A NOTE ON SUBCUTANEOUS TOXICITY OF MORELLIN AND ITS SUITABILITY FOR TOPICAL APPLICATION

WITH reference to a report<sup>1</sup> on the toxicity of morellin (the antibiotic<sup>2</sup> from *Garcinia morella*) and its unsuitability as a therapeutic agent, we have found that 2-4 per cent. solutions of morellin in sterile olive oil could be readily administered subcutaneously to mice (average weight 20-23 g.) without causing any mortality or necrosis in doses upto 450 mg. per kilogram body weight. Emulsions of the drug in Dupenol (sodium lauryl sulphonate) are not so satisfactory. The reported toxicity appears to be due to settling out of the drug at the site of injection, thus causing local irritation and necrotic lesions. The drug must be in solution in order to obviate these reactions.

2 per cent. olive oil solutions and 1 per cent. lanolin ointment have been found to be suitable for topical applications in the treatment of septic wounds and ulcers caused by pathogenic cocci, and in cases of bovine mastitis.<sup>3</sup> A detailed report of the clinical trials now in progress will be published shortly.

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April 22, 1952.

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## THE INHIBITION OF THIAMINASE BY MICRO AMOUNTS OF ACETALDEHYDE

DURING the course of an investigation on the mode of action of the carboxylase inhibitors, it was noticed that different types of curves resulted for the progressive output of CO<sub>2</sub> in a warburg respirometer when to the co-carboxylase-pyruvate system, the thiaminase from Bombay Duck (*Horpedon nehercus*) was added at the start of the experiment and after a lapse of one-and-a-half hours. Fig. 1 is a typical example.

It was thought that probably the difference in the behaviour was due to the products of pyruvate degradation, which were present in one case and were absent in the other. To test this, a series of experiments were carried out

using the human serum or the rat liver as a source of active co-carboxylase. The following combinations were studied.

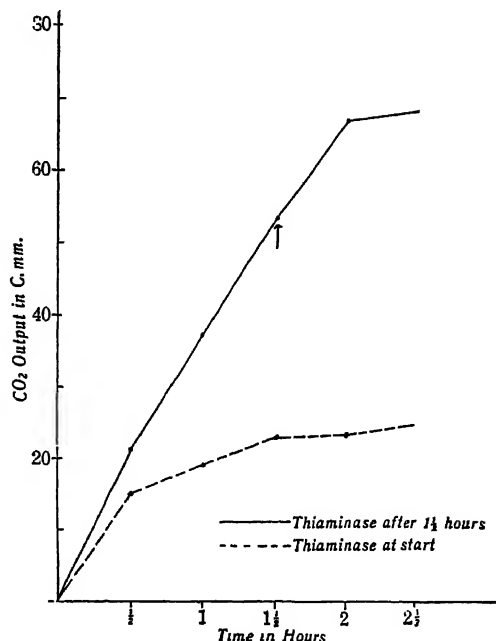


FIG. 1

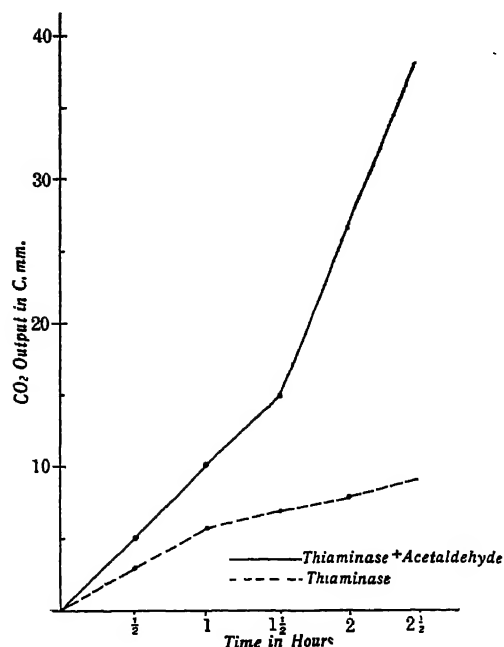


FIG. 2

- (1) (a) Serum + thiaminase.
- (b) Serum + thiaminase + acetaldehyde 0.0025%.

- (2) (a) Liver + thiaminase.  
 (b) Liver + thiaminase + acetaldehyde  
 0.0025%.

Typical curves of such experiments with serum are shown in Fig. 2, which may be compared with Fig. 1, Series 1 (b) and 2 (b) gave results almost identical to those where thiaminase was added after a lapse of time in the original series. The findings thus suggest that probably the acetaldehyde is the inhibitor of the thiaminase from Bombay Duck.

It has been reported that thiaminase is inhibited by salts of Zn, Cu, Fe.<sup>1</sup> Substances like neopyrithiamine also inhibit the action of the enzyme from carp viscera.<sup>2</sup> o-Amino-benzyl-4-methyl thiazolium chloride, however, does so by virtue of competition with thiamine for the enzyme. At present the exact metabolic function of thiaminase in fish is not understood. Its relationship with acetaldehyde—a normal product—during the oxidative decarboxylation of pyruvate—appears to be interesting. Further work is in progress to study this relationship in more detail.

Biochemistry Section,  
 Dept. of Physiology, R. G. CHITRE.  
 Seth G.S. Medical College, SHANTA KELKAR.  
 Bombay-12,  
 June 19, 1952.

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#### PAPYROGRAPHIC CHARACTERISATION AND ESTIMATION OF ORGANIC ACIDS IN PLANTS

LUGG AND OVERELL<sup>1</sup> modified the composition and the nature of the solvent phase for the papyrographic detection and separation of non-volatile organic acids by substituting formic acid in place of acetic acid, on the basis of the fact that formic acid had a higher ionization constant ( $K = 2.0 \times 10^{-4}$ ) than acetic acid ( $K = 1.8 \times 10^{-5}$ ); they reported that the former is effective in suppressing the comet effect. During our studies on the organic acid make up of plant tissues, we were confronted with the problem of determining the most effective composition of the solvent mixture for securing discrete separations and compact and well-defined spots. The following solvent mixtures were compounded and employed for papyrographic separation of organic acids,

TABLE I  
Composition of solvent mixtures

Solvent mixtures	1	2	3	4	5
Butanol	.. 10	10	10	10	5
Gasoline	.. ..	..	..	..	5
Acetic acid	.. 2.5	1.2	..	..	..
Formic acid	.. ..	..	2	2	2
Water	.. 10	4	6	5	5

Lugg and Overell<sup>2</sup> showed that 1-2 moles of acetic acid per litre of the phase, gave the best separation. By trying various concentrations of acetic acid, we found that mixture No. 2 (Table I) gave a better separation than mixture No. 1. Four volumes of water were taken for mixture No. 2, since this amount of water was found to be just sufficient to give two separate layers when mixed with 10 parts of butanol and 1.2 parts of acetic acid.

Similarly in the formic acid series the mixture composed of 10 butanol: 2 formic acid: 5 water, gives the best separation and also the yellow bands at the bottom of the chromatogram totally disappear. Besides, the substitution of formic in place of acetic acid gives better and more well-defined spots and Rf values (Table II) which are reasonably wide apart. A trial run with a solvent mixture of gasoline and butanol<sup>3</sup> did not yield any encouraging results in our hands (Table II). Best resolutions were obtained with solvent mixture No. 4; we have accordingly adopted this solvent mixture for all our studies.

*Experimental.*—The fruits chosen for our investigation were:

(1) *Averrhoa carambola* Linn.; (2) *Citrus decumana* Linn. (Pomello); (3) *Citrus limonum* (Lemon); (4) *Citrus medica* Linn. (Bitter lime); (5) *Citrus sinensis* (Orange); (6) *Morus indica* Linn. (Mulberry leaf); (7) *Phyllanthus emblica* Linn. (Gooseberry); (8) *Phyllanthus simplex* Retz.; (9) *Punica granatum* Linn. (Pomegranate); (10) *Tamarindus indica* Linn. (Tamarind); (11) *Vitis vinifera* Linn. (Unripe grapes); (12) *Zizyphus jujuba* Lamk.

Fleshy portions of the fruits (10-15 g.) were ground up with 50 per cent. alcohol acidified with acetic acid, and the mash strained through cheese cloth. The extract was made up to 20 ml., centrifuged and the clear supernatant used for papyrographic studies (preserved in a refrigerator in small bottles). Measured quantities of the extracts were spotted on rectangular sheets (20 × 22 cm.) of Whatman No. 1,

TABLE II

\* Rf values with different solvent mixtures

Organic acids	Solvent mixture No. 1	Solvent mixture No. 2	Solvent mixture No. 3	Solvent mixture No. 4	Solvent mixture No. 5
Aconitic	0.64	0.63	..	0.78	0.61
Citric	0.39	0.26	..	0.37	0.20
Fumaric	0.72	0.73	..	0.86	0.76
Glutaric	0.79	0.80	..	0.80	0.70
Itaconic	0.79	0.77	..	0.81	0.70
Lactic	..	0.63	..	0.77	0.60
Maleic	..	0.32	..	0.46	0.34
Malic	..	0.37	..	0.44	0.27
Malonic	..	0.42	..	0.60	0.58
Oxalic	..	0.17	..	0.05	..
Succinic	..	0.73	..	0.72	0.68
Tartaric	..	0.22	..	0.23	0.22
Tricarballic	..	0.63	..	0.67	0.61
Remarks	Tailing; spots not clear; a yellow band at the bottom	Tailing; the yellow band present	Unsatisfactory; spots are not well- defined; tailing	No tailing; spots compact and clear; yellow band at the bottom absent	..

\* Average for four values

rolled into the form of cylinders. After equilibration with the vapour phase in the developing chamber, papyrograms were developed with the solvent mixture No. 4 at room temperature (25-26° C.) which generally took 5-6 hours. The papyrograms were then air-dried over night and later oven-dried at 80° C. for 30 minutes. After spraying with bromo-cresol-green (40 mg./100 ml. 95% alcohol).<sup>4,5</sup> The

TABLE III

Plant material	Organic acids mg./ml.				
	Citric	Malic	Oxalic	Succinic	Tartaric
1 <i>Averrhoa carambola</i> Linn.	..	5.39	..	..	..
2 <i>Citrus decumana</i> Linn.	..	..	2.50	..	..
3 <i>Citrus limonium</i>	74.36	4.01	20.60	7.50	..
4 <i>Citrus medica</i> Linn.	18.12	1.37	2.18	..	..
5 <i>Citrus sinensis</i>	3.67	1.07	..	..	..
6 <i>Morus indica</i> Linn.	..	..	..	0.52	0.36
7 <i>Phyllanthus emblica</i> Linn.	9.60	13.50	3.53	..	1.29
8 <i>Phyllanthus simplex</i> Retz.	..	..	15.00	..	..
9 <i>Punica granatum</i> Linn. (acid variety)	37.57	..	1.2	..	..
10 <i>Tamarindus indica</i> Linn.	..	1.37	..	..	10.63
11 <i>Vitis vinifera</i> Linn.	..	5.09	..	..	4.88
12 <i>Zizyphus jujuba</i> Lamk.	12.17	3.46	4.47	..	..

presence of the different acids was indicated by well-defined lemon yellow spots against a blue background, and by developing papyrograms of known reference mixtures along with those of extracts and by a reference to the Rf values determined by us (Table II), the acids occurring in the mixture could be characterized. The area occupied by a given spot was found to give us a measure of the quantity of the acid present in the extract. Since the quantity of the extract used for spotting is known, it has been possible to express the quantity of the constituents of the mixture as milligrams per ml. The results are given in Table III.

Of the citrus fruits examined, the *Citrus limonium* contains the highest amount of citric acid and also a surprisingly high proportion of oxalic acid. Among the non-citrus fruits, *Punica granatum*, the acid variety of pomegranate, contains citric acid to the extent of 95 per cent. with a trace of oxalic acid. It is surprising that *C. decumana* does not contain any citric but only oxalic acid. Tamarind contains, as expected, about 88 per cent. of tartaric acid, malic accounting for the remaining portion of the acidity. No other acids are present. The grape contains exclusively the tartaric and malic acids in almost equal proportions. The two members of the phyllanthus family—*P. emblica* and *P. simplex*—show interesting differences. The medicinally important *Embllica* show high proportions of the citric and malic

acids with low percentages of oxalic and tartaric acids while simplex consists of only oxalic acid to the absolute exclusion of other acids.

Our grateful thanks are due to Prof. M. S. Thacker, Director, Indian Institute of Science, for his kind interest.

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Bangalore-3.  
June 11, 1952.

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M. SREENIVASAYA.

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#### AN AQUATIC GLOW-WORM FROM ALLEPPEY

THE earliest record of aquatic Lampyrid larvæ is that of Annandale<sup>1</sup> from Malaya. In 1906, the same author<sup>2</sup> recorded another larva, *Luciola vespertina*, from Calcutta. Later the larva of *Pyrophanes similis* was recorded by Blair<sup>3</sup> from S. Celebes and the aquatic larvæ of two species of *Luciola* were collected by Okada<sup>4</sup> from Japan.

All the above forms are different from the aquatic Lampyrid larva collected in November, 1951, from a weedy fresh water tank at Alleppey, about a mile and a half from the seacoast. The larva is purely aquatic and it lived in water for over a month, after which it was preserved.

The larva measures about 21 mm. in length. It is sooty brown above with faint ochraceous longitudinal stripes along the dorsal carinæ which characterise the tergites. The structure of the head and the mouth parts and also the nature of the carinæ and posterior marginal protuberances of the tergites resemble more or less the larva formerly described by the author<sup>5</sup> from a marshy locality at Trivandrum. The present larva seems to be an advanced instar of the larva from Trivandrum, which also must have been aquatic. This differs from *L. vespertina*, the only other aquatic Lampyrid larva known from India, in the absence of the star-shaped funnel-like adaptation for respiration. But as Annandale does not give the minute structural details of the larva and as the star-shaped funnel referred to may be the "anal brush," so characteristic of all Lampyrid larvæ, it is not possible to consider the two larvæ as belonging to the same species.

The present larva is a voracious feeder on the fresh-water snail, *Planorbis exustus*. While feeding it curls up the abdomen and emits a powerful light from inside water. The larva avoids light and clings to the weeds and thus remains hidden during the daytime. It is interesting to note that all the hitherto recorded species of aquatic Lampyrid larvæ are Asiatic and they have been recorded only from India, Malaya, S. Celebes and Japan.

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Sanatana Dharma College,  
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March 31, 1952.

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#### MYIASIS OF THE URINARY PASSAGE IN HUMAN MALE

MYIASIS of the human urinary passage appears to be extremely rare.<sup>1-4</sup> Most of the myiasis-producing Diptera in man listed by Strickland and Roy<sup>6</sup> were recorded from places other than the urinary passage. Riley and Johansen<sup>5</sup> refer to two species of maggots, viz., *Fannia canicularis* from a woman having albuminuria and *Psychoda albipennis*, from a boy in Scotland. Species of *Chrysomyia* and *Lucilia* have been successfully reared for a few days in human urine.

The present record is from a young man, who appears to have got the infection some months back. During each micturition, he was passing out about a dozen maggots. This continued for over two months and now he has ceased to produce them. The patient does not seem to have been affected seriously.

The larvæ passed out at a time belong to more than one instar and they live in the urine outside for a few hours only. They are pale yellow in colour and cylindrical in shape, with attenuated anterior end (Fig. 1). The maggots measure from 4 mm. to 7 mm. in length. The body is twelve-segmented. The cephalopharyngeal sclerites are well developed. The mandibular sclerites are paired and sharp. The respiratory system is amphineustic with anterior spiracles digitately lobed and posterior spiracles borne at the end of a pair of minute tubercles (Fig. 2). The posterior spiracles are incompletely sclerotised and each consists of three chitinous areas with three bunches of setæ. The



structure of these maggots reveals the fact that these are different from all the myiasis-producing larvæ recorded so far. Attempts to rear the maggots into flies have failed and it is impossible at present to make a specific identi-



FIG. 1

FIG. 2

Maggots from human urine.

Left:—Two maggots entire.

Right:—Posterior end showing spiracles.

fication of the maggots. I place them under the family *Anthomyidæ*. I also believe that the man must have acquired infection through the flies laying eggs at the external meatus and the minute larvæ hatched out creeping directly upto the bladder. A more detailed work on the minute anatomy of these maggots is in progress.

My thanks are due to Dr. S. P. Pillay, for permitting me to examine the urine of his patient and also to Dr. Krishnan, for permitting me to take the photomicrographs at the University Research Laboratory, Madras.

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March 31, 1952.

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### RATOONING IN PADDY

RATOONING in paddy is not a common practice. In some places it is practised on a small scale.<sup>1,2</sup> At the Rice Experimental Area, Sabour, experiments were conducted to determine the height at which the crop should be harvested for better ratoon yield.

**Experimental Details.**—One of our *Aus* selection CH 10 was grown in six blocks in a plot

of fairly uniform fertility. Each of these blocks had four equal strips. When the crop came to maturity it was harvested on 8th October, when the stocks were still greenish at four different heights (treatments) in each block. These treatments were randomised and replicated six times.

Soon after the harvest the plot was irrigated and weeded and the stubbles were allowed to grow.

**Flowering and Maturity.**—Except the shoots which developed from the first node and those which came up from the underground nodes, all others in the various treatments came to flower in about two weeks' time from the date of harvest and in another 20 to 25 days they reached maturity. Flowering in shoots from the first and the underground nodes were irregular and the grain setting was poor.

The ratoon crop was harvested on 17th November. It may thus be seen that the ratoon crop takes only about 40 days to reach maturity as against the main crop which reaches maturity in about 120 days from the date of sowing.

**Yield from Various Treatments.**—Average yield from two years' data are given in Table I. These results were put to statistical test and were found to be significant.

TABLE I

Showing yield per acre of the various treatments

Treatment	Average yield in lb. per acre	
	Main crop	Ratoon crop
A. Harvested close to the ground	1636.2	60.6
B. Harvested at about 6" above ground (i.e., the height at which the crop is ordinarily harvested)	1595.8	242.4
C. Harvested at half the height about 14" above ground	1616.0	505.0
D. The ears were picked up	1626.1	444.4

It may be seen from the above Table that the best ratoon yield of 505.0 lb. per acre—which is about 31 per cent. of the yield of the main crop—is obtained from treatment C, where the crop was harvested at half the height.

Lastly, it may be mentioned that except the viability of the seeds, other characters like plant height, panicle length, spikelet size, number of fertile shoots and grain setting were less pronounced in the ratoon crop.

Grateful thanks are due to Dr. R. H. Richharia for providing facilities for the work.

Botanical Section,  
Sabour,  
May 17, 1952.

A. B. SARAN.  
MANOJ PRASAD.

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### OCCURRENCE OF *TILLETIA TRANSVAALENSIS* IN MYSORE

COLLECTIONS of smut fungi in the neighbourhood of Bangalore included a species of *Tilletia* on *Eragrostis tenuifolia* Hochst. which is a common grass in dry localities. The sori were ovaricolous appearing as elongated bodies protruding out of the enveloping glumes and covered with thick brownish-yellow membrane, which flaked away at maturity revealing dark-brown spore mass. The chlamydospores were reddish-brown under the microscope, 20-26  $\mu$  in diameter with a mean of 23  $\mu$ . The episore was thick with warty projections giving an echinulate appearance for the spores.

Comparative studies indicated that the *Tilletia* species under study is identical with *T. transvaalensis* described by Zundel from South Africa and has also been recorded in Benaras, India.<sup>1</sup> It may be of interest to note that very few species of *Tilletia* are known in South India as compared with the number known in North India. Only two species of *Tilletia* are known from Mysore including the one reported in the present study, the other species being *T. narayanaraoana* Mundkur & Thirum. on *Panicum trypheron* Schult.

Agricultural College, H. C. GOVINDU.  
Hebbal,  
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June 12, 1952.

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### CHROMOSOME NUMBERS IN THE GENUS *ZIZYPHUS*

THE chromosome numbers of *Zizyphus jujuba* (Indian jujube), *Z. sativa* (Chinese jujube) and *Z. sativa* as *vulgaris* have been previously reported to be  $2n = 24$ , 24 and 26 respectively.<sup>1</sup> Srinivasachar<sup>2</sup> has reported the haploid chromosome numbers of *Z. jujuba* and *Z. aenoplia* to be 20 and 10 respectively. Bowden<sup>3</sup> has reported the haploid chromosome number of both

*Z. jujuba*, Mill. and *Z. jujuba* Mill. var. *inermis* as 12. Investigations on the comparative morphology and cytology of a few members of this genus found in a small area of about a square mile round about Surat, revealed that they comprised plants of the following species with chromosome numbers mentioned against them :

I	<i>Z. rotundifolia</i> , Lamk.	..	..	..	36
II	<i>Z. aenoplia</i> , Mill.	..	..	..	24
III	<i>Z. mauritiana</i> , Lamk.:—	plant No. 1	..	..	24
		..	2	..	24
		..	3	..	24
IV	<i>Z. jujuba</i> , Mill.:—	plant No. 1	..	..	24
		..	2	..	36
		..	3	..	36
		..	4	..	36
		..	5	..	48
		..	6	..	48
		..	7	..	48
		..	8	..	48
		..	9	..	48
	(‘seedless bor’)	..	10	..	48

The chromosome numbers were counted during meiotic stages like diakinesis, first or second metaphase or anaphase in pollen mother-cells, either from temporary acetocarmine smears or from permanent smears stained with iodine-gentian-violet. The chromosomes in all of these were small. Secondary association of bivalents during first and second metaphase was observed in all the above plants but could not be analysed for want of sufficient number of clear metaphase plates. In *Z. rotundifolia*, meiosis was found to be normal resulting in regular tetrads. In the case of *Z. aenoplia*, lagging chromosomes were noticed during the first anaphase which subsequently formed themselves into micronuclei. The three individual trees of *Z. mauritiana* studied, though having the same number of chromosomes, were morphologically distinct from each other. Meiosis in each of them was normal. The ten plants studied in *Z. jujuba* belong to a regular polyploid series. One of them had  $n = 24$ , three had  $n = 36$  and six had  $n = 48$  chromosomes. Meiosis was normal in plants with  $n = 24$  or 36 chromosomes resulting in regular tetrads and fertile pollen grains. Only two plants with  $n = 48$  chromosomes exhibited normal meiosis. In the remaining four plants of this group, meiosis was normal only in some of the pollen mother-cells, while in the rest various meiotic irregularities like lagging chromosomes, formation of multivalents and unequal anaphasic separation were observed. In these, the pollen at the time of anther dehiscence was found to be mostly degenerated and polymorphic in

nature. Fruits borne on plant number 10 did not develop well-formed stones. Consequently, this tree was locally known as 'seedless bor'. All the ten plants of this species differed from one another in morphological characters. Detailed comparative morphological and cytological studies have been carried out in all the above plants and will be published elsewhere.

My grateful thanks are due to Sri. G. B. Patel for bringing to my notice the 'seedless bor' and to Dr. D. Chatterjee for the identification of the plants except *Z. rotundifolia*.

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Agric. Experimental Station,  
Surat,  
March 24, 1952.

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# **ASPERGILLUS FLAVUS LINK, A PARASITE OF THE DESERT LOCUST (*SCHISTOCERCA GREGARIA* FORSK.)**

*Aspergillus flavus* Link is a common air-borne mould and grows saprophytically on a wide variety of substrata, viz., grains and cereal products, leather goods, dairy products, home-canned fruits and vegetables, textiles, paper pulp, etc., and has been commonly isolated from soil, particularly in tropical and sub-tropical areas. Instances are, however, not uncommon where it has been found to be pathogenic, particularly on insects.

Dade and Wright<sup>1</sup> found it parasitic on the locust, *Locusta migratoria migratorioides* from Gold Coast, and Naumoff<sup>3</sup> and Lepesme<sup>2</sup> described its occurrence on Desert locust (*Schistocerca gregaria*) in Central Asia and North Africa. There seems, however, to be no record of its occurrence on the Desert locust in India so far.

Recently, a number of adult locusts (*Schistocerca gregaria*) in the cages at the Locust Laboratory of the Director, Locust Control in India, New Delhi, were found affected with *Aspergillus flavus* during September and October last. The affected insects developed yellowish grey patches on the sternum and thoracic regions, became very sluggish, and eventually stopped feeding. They died in 24 to 48 hours of the development of these symptoms.

Whitish and later greenish olive conidiophores of the fungus spread over the entire body.

During the course of preliminary experiments it was observed that the adults were more susceptible to disease than the hoppers. Mortality amongst the adults was more common during mid-September to October and gradually declined subsequently. Evidently the low temperatures towards the end of October and onwards did not favour the development of the disease.

The writer is highly indebted to Dr. H. S. Pruthi, Plant Protection Adviser to the Government of India, and Mr. C. B. Mathur, for the specimens and for kindly going through the manuscript.

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Government of India,  
New Delhi.  
March 31, 1952.

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# **ANTHER AND POLLEN GRAINS OF *ZANNICHELLIA PALUSTRIS* L.**

WHILE a detailed investigation on the stamen of this plant awaits publication by the author, a few interesting points may be recorded here.

According to Campbell<sup>1</sup> the pollen grains contain two nuclei at maturity. He designates as tapeum about three layers of cells surrounding the sporogenous mass.

My observations reveal the presence of only a single layer of tapetal cells surrounding each of the four groups of sporogenous cells. The generative nucleus divides and the pollen grains attain the three-nucleate condition within the anther (Figs. 1 a, b). A tapetal periplasmodium is formed in which the tapetal nuclei lie free amidst the pollen grains (Fig. 2). As there is practically no degeneration of microspore mother-cells, probably it is to these free tapetal nuclei that Campbell refers when he writes "not all the sporogenous cells give rise to spores; but a certain number are broken down and their free nuclei can be observed among the young spores."

A few twin anthers have been noticed. Each of these contains eight loculi and a common vascular trace (Fig. 3).

The present record for *Zannichellia* adds yet another member to the list of the Helobiales where, as a rule, the pollen grains are three-celled at shedding.

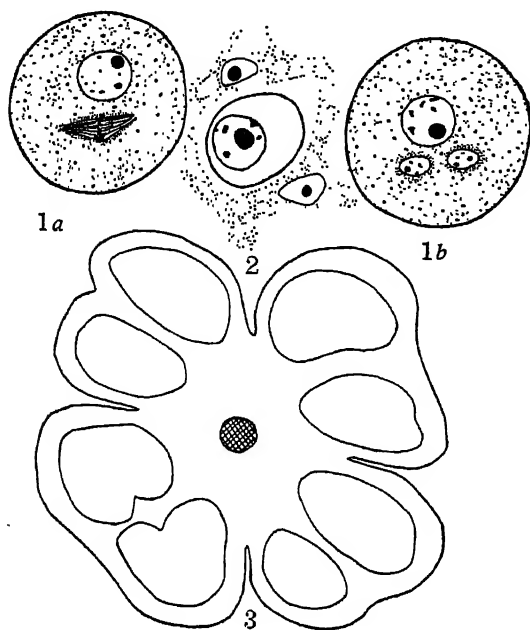


FIG. 1 Starch filled pollen grains with the generative nucleus dividing (a), and the two male cells (b).  $\times 1270$ .

FIG. 2. Young pollen grain surrounded by periplasmodium with tapetal nuclei lying free.  $\times 1270$ .

FIG. 3. T.S. of a twin anther showing eight loculi and a single vascular trace.  $\times 195$ .

I am indebted to Prof. P. Maheshwari for help in this investigation.

Dept. of Botany,  
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May 24, 1952.

C. S. VENKATESH.

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#### **SOLANUM MELONGENA VAR. BULSARENSIS VAR. NOVA, ARGIKAR**

A BRINJAL plant differing sharply from the varieties so far described in several of its morphological characters was noticed in a cultivator's field at Dharwar (Bombay State) in 1949. The progenies of this plant raised in 1950 and 1951 were found to breed true for all its undermentioned characters.

*The Plant*.—A semi-erect lustrous herb about 2' tall, neither woolly nor scurfy, entirely

spineless appearing in its young state like one of the *Nicotiana* spp. *Stem*.—Woody, round, smooth, glabrous, conspicuous and deep purple in colour bearing at every node mostly two or rarely three leaves, the cortex being comparatively softer, thicker and more leathery. *Leaves*.—Simple, large, green and thinner, about  $13'' \times 8''$  when borne at the base and about  $8'' \times 4\frac{1}{2}''$  when borne above, sessile, more or less elliptic, subentire and shallowly lobed, soft and shining, neither hairy nor tomentose. Midrib: spineless, completely purple on the dorsal side and up to over half its length on the ventral side, the veins being purplish on the dorsal side and greenish on the ventral side. *Flower*.—Either solitary or in clusters of two, three, four or more, 46-53 mm. in diameter having 5 oblong petals, the purple veins on the bluish spreading corolla being prominent. Calyx: distinct, having 5 leaf-like lustrous sepals, either green or with a development of purple pigmentation, the nerves being deep purple and prominent, more pronounced on the dorsal side, the venation of the sepals resembling that of the leaves; the calyx is abnormally persistent, the sepals being 40-70 mm. long and 15-30 mm. broad sometimes running along the entire length of the fruit or often opening out fully exhibiting the ventral surface of individual sepals. Anthers: 5, deep yellow. Ovary: superior with a long style. *The Berry*.—Glabrous, white, attractive, glossy and roundish, 70-90 mm. in diameter, rarely with very minor incisions appearing like a raw tomato fruit in shape having the colour of a white apple; rarely with faint purple shades, turning brown on maturity; borne either singly or in clusters of two, three or four fruits. Epicarp: thin, smooth and tough; Mesocarp: thick, the seeds being located nearer the central part of the fruit and not spread all over. The berry gets tough and hard as it attains maturity and on drying loses most of its moisture, the pericarp getting thinner and shrivelled, the epicarp turning dark brown, retaining its lustre. The fruit stalk: tough, abnormally short, 16-22 mm. in length holding the fruit semierect besides the stem.

There being a number of types of *Solanum melongena* no comparative description of any of them is cited here. According to Prof. Santapau, however, the plant described above appears to be nearest to the variety *inermis* of Dunal from which it differs mainly in the size of leaves, calyx, etc. Dunal, however, remarks that *inermis* is rather variable whereas this one

seems to be sufficiently distinct to make it a new variety, if not a new species.

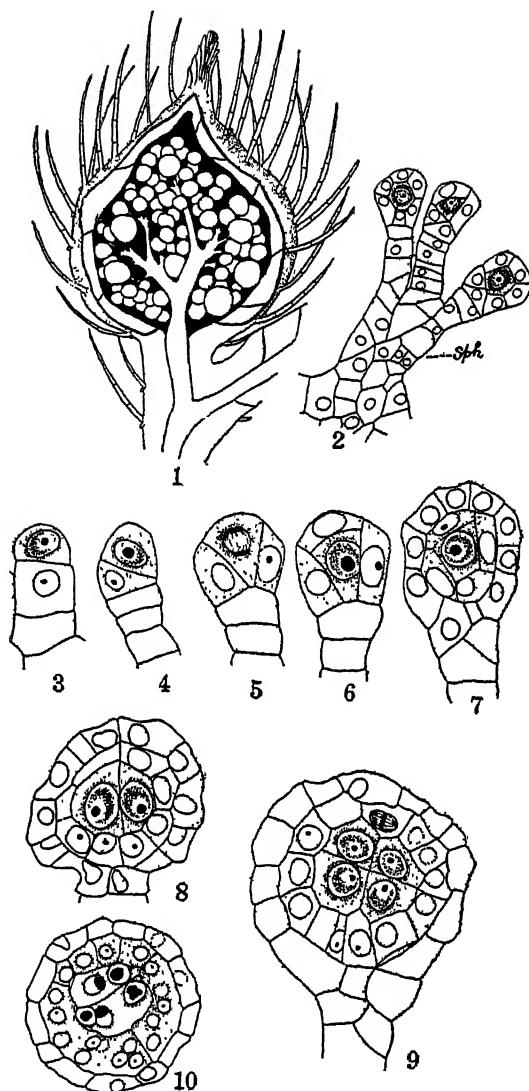
The chromosome number of this plant is yet to be determined. Crosses effected between this type and some Gujarat varieties failed to set.

Bombay Agricultural Dept., G. P. ARGIKAR.  
Bulsar, Surat,  
April 7, 1952.

# APOGAMY IN SALVINIA

APOGAMY is known to occur in many ferns most of which, with the exception of *Marsilia Drummondii* studied by Strassburger,<sup>1</sup> belong to Leptosporangiatæ especially Polypodiaceæ. While investigating the causes of failure of the spore germination in three species of *Salvinia* locally available, viz, *S. auriculata* Aublt., *S. cucullata* Roxb., and *S. natans* Hoffm., it became necessary to investigate their cytology in detail which revealed the presence of apogamy in the genus. Due to apogamy the microspores are not normally formed in *S. auriculata*; whereas the megaspores are not healthy in *S. cucullata* as was observed by Deshpande.<sup>2</sup> In *S. natans* mega- and microspores are normally formed and are viable. The pattern of apogamy was closely followed in the microsporogenesis of *S. auriculata* and is as follows:

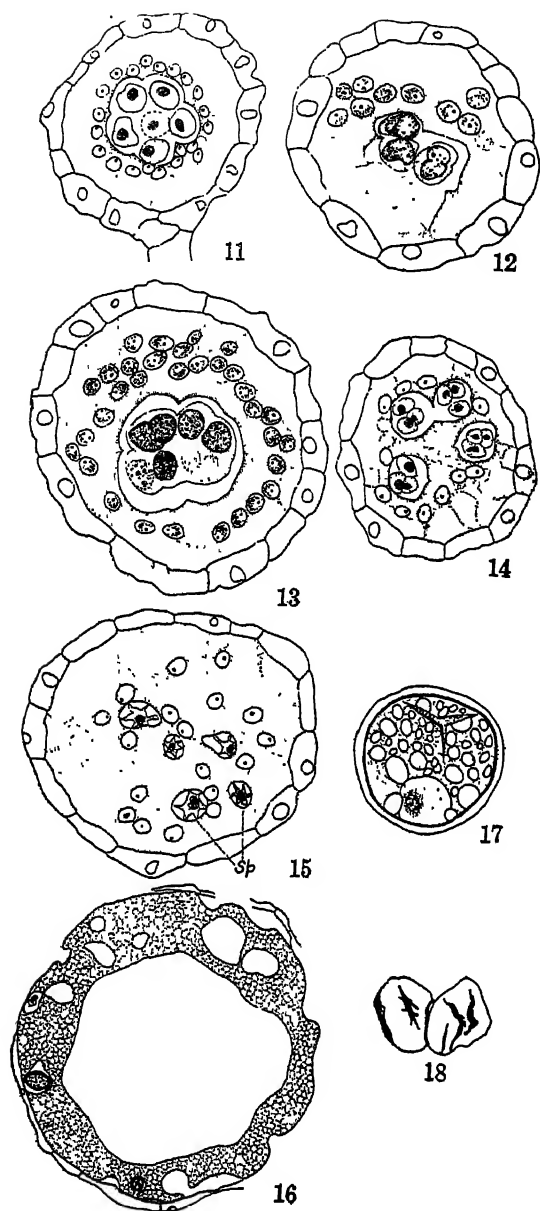
The sporangia in *Salvinia* appear basipetally in bunches of 2-4 each on short stalks, the so-called sporangiophores, radiating from the central receptacle (Figs. 1 and 2, sph). They develop as in a typical Leptosporangiate fern, by forming a large tetrahedral archesporial initial (Figs. 3 and 7) surrounded by a layer of tepetum (Figs. 7 and 9). The four primary tapetal cells multiply and form an envelope round the primary sporogenous cells by the disorganization of their walls while the latter are undergoing reduction division (Figs. 9-11). The primary sporogenous cell in a microsporangium gives rise to two, four and eight spore mother-cells by successive mitoses (Figs. 8-11), but in the next division which is premeiotic, irregularities in the chromosomal cycle are introduced (Figs. 12 and 13). The eight spore mother-cells undergo incomplete nuclear division (Fig. 12) and form new eight or some times less spore mother-cells by the fusion of the adjacent nuclei (Figs. 12 and 13). The nuclei of the original eight spore mother-cells pass through prophase, metaphase and sometimes incomplete anaphase also, but the telophase neither follows nor is completed.



FIGS. 1-10. *S. auriculata* Aublt. showing deviations in the microsporogenesis leading to apogamy.

FIG. 1. A sporocarp in *L. S.* showing the arrangement of the microsporangia,  $\times 18$ . FIG. 2. A sporangiophore, sph, with three sporangia,  $\times 73$ . FIG. 3. A sporangial initial,  $\times 622$ . FIG. 4. A young sporangium with wall cell cut off,  $\times 622$ . FIGS. 5-6. The same with 2 and 3 wall cells cut off,  $\times 622$ . FIG. 7. A young sporangium with the primary sporogenous cell surrounded by 4 tapetal cells,  $\times 622$ . FIGS. 8 and 9. Young sporangia with 2 and 4 sporogenous cells  $\times 622$ . FIG. 10. Same with tapetal cells breaking down, their nuclei surrounding the spore mother cells,  $\times 370$ .

The result is, that the nuclei of the two incompletely divided cells fuse in pairs and form again eight large, diploid, oval, dumbbell- or club-shaped nuclei with incomplete cytoplasmic



FIGS. 11-18. *S. auriculata* Aublt. Massula and microspores.

FIG. 11. A sporangium showing 6 spore mother-cells separated out,  $\times 370$ . FIG. 12. Dividing spore mother cells fusing in pairs to form restitution nuclei.  $\times 475$ . Note the tapetal nuclei surrounding them. FIG. 13. Restitution nuclei formed,  $\times 475$ . FIG. 14. Restitution nuclei undergoing reduction division and forming spore tetrads,  $\times 370$ . FIG. 15. A young massula with five spores seen in it,  $\times 37$ . FIG. 16. An adult massula which is hollow,  $\times 37$ . FIG. 17. A fully formed spore,  $\times 622$ . FIG. 18. Two sterile spores,  $\times 622$ .

division (Figs. 12 and 13). The eight restitution nuclei so formed revert to the resting con-

dition for a while as in *Nephrodium hirtipes*,<sup>3</sup> *Aspidium filix-mas*,<sup>4</sup> *Aspidium remotum*,<sup>4</sup> *Polystichum tssumense*,<sup>5</sup> *Adiantum lunulatum*,<sup>6</sup> *Cyrtomium falcatum*,<sup>7</sup> etc. (Fig. 13). Later on these nuclei undergo meiosis (Fig. 14) and form 32, but generally less, 20-28 microspores in *S. auriculata*. Presumably here some of the spore mother-cells degenerate as in *Marsilia Drummondii* or form imperfect spores which have no capacity to germinate.

By the time the eight restitution nuclei are undergoing reduction division, the tapetal nuclei lose their walls (Figs. 11-14), their protoplasm forming a sort of pseudocellular frothy mass—the massula—in which ripe and unripe or abortive spores come to lie at the periphery by surface tension (Figs. 16, r.s. and u.s.). The process of massula formation is not the same in all species. There are many abortive spores in the massula of *S. cucullata* and *S. auriculata* but none in *S. natans*. Some of the previous workers<sup>8</sup> on the last-named species have reported 8 or 16 as the number of spore mother-cells in a microsporangium and also two different numbers of microspores, 32 and 64. The numbers of chromosomes reported also vary: 4 and 8 or 16. Judging from their figures and these facts, there seems to us a strong possibility of having some semi-sterile races of this species, namely, *S. natans*, which also may be reproducing apogamously. But this is a point which will need further investigation.

The megasporogenesis also shows irregularities which will be discussed later. In the meantime it may be stated here that the pattern of apogamy in *S. auriculata* described here agrees with that in *Nephrodium hirtipes*, *Aspidium remotum*, etc., in which the irregularities in the chromosomal cycle are introduced in the life-cycle of the plant at the eight-celled spore mother stage. To the best of our knowledge this is perhaps the second instance of apogamy known in any heterosporous fern, the first one being that of *Marsilia Drummondii* reported by Strassburger.<sup>1</sup> Further work is in progress.

Dept. of Botany,  
Inst. of Science,  
Bombay-1,  
November 25, 1951.

T. S. MAHABALE.  
JOYCE D'MELLO.

1. Strassburger, *Flora*, 1907, 97, 123-188. 2. Deshpande, *J. Indian Bot.*, 1943, 22, 49-84. 3. Steil, *Ann. Bot.*, 1919, 33, 109-132. 4. Dopp, *Manual of Pteridology*, 1932, 271-274. 5. Patterson, *Bot. Gaz.*, 1942, 104, 107-114. 6. Mehra, *Proc. Nat. Acad. Sci., India*, 1944, 14, 189-204. 7. Manton, *Problems of Cytology and Evolution of the Pteridophyta*, 1950, 158-248. 8. Yasui, *Ann. Bot.*, 1911, 25, 469-483; Heinricher, *Sitzb. der K. Akad. der Wiss* 1882, 87, 494.

MICRODETERMINATION OF  
SELENIUM

A TURBIDO-COLORIMETRIC method for determination of very small amounts of selenium in natural materials such as soil, water and food-stuffs has been developed. It has been discovered that ascorbic acid reduces selenious and selenic acid and its salts in acid solution even in the cold and is much stronger than hydroxylamine used by Klein.<sup>1</sup> Another advantage is that ascorbic acid can be used directly even in the presence of iron, copper, nitric acid and other oxidising agents. The reduction is quantitative and the fine brown turbidity obtained is measured in a Lumetron photo-electric colorimeter with the 5.30 m $\mu$  green filter. The method is sensitive even in a concentration of 1  $\mu$ g./ml. of selenium in the test solution and a straight line curve is obtained upto 5  $\mu$ g./ml. selenium. Stronger solutions are suitably diluted. Repeated runnings on the same or equimolar solutions give reproducible results. Added selenium is quantitatively recovered. Accurately weighed dried material is digested with pure sulphuric acid. When the digest has liquefied, 2 drops of nitric acid are added and the digestion continued. If the digest has not clarified 1 or 2 drops of 60 per cent. perchloric acid are added and further digested. The incineration is complete in half an hour. Too strong boiling is avoided. When white fumes appear, the digest is cooled, diluted with water and made upto a known volume with filtration if necessary. 8 ml. aliquots are taken, warmed, 2 ml. ascorbic acid solution (20-40 mg./4 ml.) added, mixed, transferred to the comparison tube, transmission noted and the selenium value interpolated from the standard reference curve (Fig. 1). The standard curve is prepared by taking 8 ml. portions of standard solutions containing 1  $\mu$ g., 2  $\mu$ g., 3  $\mu$ g. and 5  $\mu$ g. selenium per ml. respectively and adding 2 ml. ascorbic acid solution (20 mg./1 ml.) in 10 per cent. sulphuric acid as above. The transmissions are plotted against concentrations. Selenium solution without ascorbic acid is taken at

100% transmission. Change in the pH of the test solution or increased ascorbic acid concentration does not interfere. For water sam-

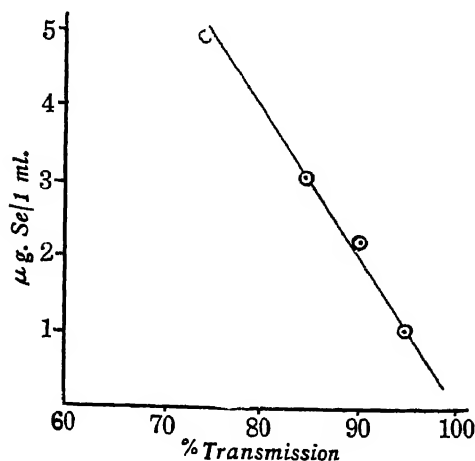


FIG. 1.

ples digestion with sulphuric acid alone is necessary. A few typical results are given in Table I.

TABLE I

Substance	Se content (mg/100 g. dry matter)				
	added	found	recovered	% recovery	
<i>P. sativum</i>	..	..	1.2	..	..
<i>L. sativus</i>	..	..	22.5	..	..
<i>L. esculenta</i>	..	..	2.3	..	..
"	2.5	4.7	2.4	96.0	

Details will be published elsewhere. We are indebted to the British Drug Houses Ltd., for the gift of sodium selenite.

Dept. of Medical Chemistry, M. N. RUDRA.  
Darbhanga Medical College, STULI RUDRA.  
Laheriasarai,  
Bihar,  
May 10, 1952.

1. Klein, A. K., *J. Assoc. Official Agr. Chem.*, 1941, 24, 363.

## PROF. K. S. KRISHNAN

PROFESSOR K. S. KRISHNAN, F.R.S., Director, NPL, Delhi, has been nominated by the Government of India as India's delegate to the meetings of the Executive Committee and the Xth General Assembly of the URSI to be held at Sydney from August 8

to August 23, 1952. Dr. Krishnan will also attend the meetings of the Australian and New Zealand Association for the Advancement of Science to be held at Sydney from August 20 to August 27, 1952, as a representative of the Indian Science Congress Association.

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## REVIEWS

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**The Theory of Electromagnetic Waves—Symposium.** (Published by Interscience Publishers Inc., New York), 1951. Pp. viii + 393. Price \$ 6.50.

This book is practically a reprint of the papers published in the Journal, *Communications on Pure and Applied Mathematics*, which were originally contributed for a symposium held at the New York University in 1950. The interest in the classical theory of electro-magnetism, which had flagged in the earlier years of this century, was suddenly accentuated as a result of the demands of both industry and defence during the last war, and the great progress which took place in the use of high frequency radio waves. Entirely new methods of approach have been developed in the theory of diffraction of electromagnetic waves and of their reflection and propagation in heterogeneous media, particularly as a result on the work of Schwinger and his co-workers. It is only appropriate, therefore, that the book should begin with a paper by H. Levine and J. Schwinger on diffraction by an aperture in a conducting screen. The symposium covers a wide variety of topics—diffraction theory of Gaussian optics, wave propagation in non-homogeneous and stratified media, scattering and diffuse reflection of electromagnetic waves, microwaves, theory of wave-guides, diffraction of pulses and magneto-ionic triple splitting in the ionosphere.

It is impossible to refer in detail to the individual articles as they are highly specialised. The book is sure to lead to a large amount of new theoretical work on electromagnetic waves. Mathematicians in our country should greatly profit by a perusal of its contents, since a wide range of new problems has been thrown open as a result of some of these fundamental studies.

G. N. RAMACHANDRAN.

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**Cosmology.** By H. Bondi. (Cambridge University Press), 1952. Pp. 179. Price 22 sh. 6 d.

Various theories have been put forward right through the ages regarding the nature and structure of the Universe, but these have been in the nature of speculations in the realm of philosophy. Cosmology as a branch of physics became important only in the present century,

mainly after the advent of the theory of relativity. The book under review gives an able summary of the different theories that have been proposed, presenting the salient points in each and also a critical appraisal of their contents.

Cosmology deals with the Universe *as a whole* and it is not surprising that all the theories deal with the nebulae as units and make no attempt to explain the detailed structure on a smaller scale. It was Einstein who first applied his general theory of relativity to the structure of the Universe and concluded that the only possible Universe is one which is finite (though unbounded) and absolutely static. Immediately after, de Sitter showed that Einstein's equations also led to a model which is continuously expanding. This remarkable result of de Sitter whose main interest at first lay in the fact that it proved that Einstein had been wrong, was corroborated by the later experimental studies of Hubble and others. Many other models were then proposed for the "Expanding Universe", associated with the names of Lemaitre, Eddington and others. All these make use of a so-called cosmological principle, according to which the appearance of the Universe is the same for all observers at the same instant; but in all of them the average density of the Universe decreases continuously and in most of them, the Universe has a finite age. Very recently, however, Bondi (the author of this book) and Gold pointed out that a Universe could be constructed, which satisfies the "perfect" cosmological principle, according to which it should appear similar to all observers not only at one particular instant, but at all times. This is attained by a continuous creation of matter, the rate of which (a hydrogen atom per litre in  $10^9$  years) is, however, so small as not to contradict the law of conservation of mass to any appreciable extent. There is no restriction on the age of the Universe in this theory. The theory has also been put in relativistic terms by Hoyle. Naturally, the author believes that his "steady state theory agrees best with observation and has the simplest and most logical basis".

The book also contains brief sketches of the unorthodox theories of Milne (Kinematic Relativity), Eddington (Fundamental Theory)



Dirac and Jordan. The whole subject has been presented in a very balanced manner, with greater emphasis on the physical aspects rather than on pure mathematics. The book will be found to be a useful reference book by workers in the field. For the layman, it shows what extensive researches have been carried on in this abstruse field where observational facts are so meagre and the theories hover on the fringe between physics and philosophy.

G. N. RAMACHANDRAN.

**Safety Measures in the X-Ray and Radio-Active Laboratory.** National Bureau of Standards Handbooks. No. 47. *Recommendations of the International Commission on Radiological Protection and of the International Commission on Radiological Units*, 1950. Price \$ 0.15. No. 48. *Control and Removal of Radio-Active Contamination in Laboratories*. Price \$ 0.15. No. 49. *Recommendations for Waste Disposal of Phosphorus-32 and Iodine-131 for Medical Uses*. Price \$ 0.10. No. 50. *X-Ray Protection Design*. Price \$ 0.10. No. 51. *Radiological Monitoring Methods and Instruments*. \$ 0.15. Available from the Superintendent of Documents, Washington 25, D.C.

The use of radio-active materials and other sources of radiation in research and industry has increased to such an extent recently that the need for providing suitable protection from the ill-effects arising from them has become very urgent. The series of handbooks listed here which have been brought out by the National Bureau of Standards are, therefore, timely and contain the relevant information in a compact and readable form. They contain data about a wide variety of topics—the actual safe limits of radiation which is permissible in the laboratory, both for short duration as well as over extended periods; the instruments and methods by which the intensity of various types of radiation can be measured; details of the methods available for reducing radiation to within the safe limits; procedures for removing radio-active contamination both from the laboratory and from the dress and body of the workers; disposal of the radio-active isotopes used in biological and medical experiments.

The scope of the various handbooks is clear from their titles; and no special remarks are needed. However, it must be mentioned that the booklets are, one and all, particularly thorough and contain all the relevant instructions required in actual practice. Particularly in our country where work on these lines is rather limited, there is a tendency to under-

estimate the hazards arising from the presence of penetrating radiations and, therefore, one cannot too strongly recommend that every worker who is carrying out investigations using radio-active materials or X-rays should use these handbooks and take all the necessary precautions outlined in them.

**Science German Course.** By C. W. Paget Moffatt. Revised by Joseph Horne and H. T. Betteridge. 5th Edition, 1952. Pp. vii + 325. Price 9 sh. 6 d.

The first part of the book dealing with grammar (Pages 1-98) has been re-written. Part II (Pages 99-110) contains simple readings for the beginner on general topics as "House and Garden", "The Laboratory", "Iron", etc. On pages 111-112 a list of the quoted periodicals is given. Part III (Pages 113-283) contains extracts from standard text-books and scientific journals grouped under "Physics", "Chemistry", "Mathematics", etc. This part has been brought up to date by inserting a great number of new reading passages from modern journals and deleting a number of extracts of the previous editions. The new revision is certainly a great improvement over the former editions. Especially the vocabulary (Pages 284-325) is a welcome addition.

In Part I, pains have been taken to render the student of German every help to find his way through the difficulties of idiomatic peculiarities. However, the following suggestions and corrections might be taken into consideration for future editions: it does not seem advisable (after a chapter on pronunciation) to begin with the Word Order. This matter can find its place after the treatment of the verb. The examples under § 18 where the subjunctive (indirect speech) comes in question, should be substituted by simple ones. The translation "er sagt, dass er gestern käme" for "He says that he came yesterday" is wrong. Correct is only "...dass er gestern gekommen sei" or "dass er gestern kam". Examples illustrating the various uses of the prepositions as found in previous editions have unfortunately been deleted. The treatment of the subjunctive was more systematic in the old editions. A paragraph on the use of tenses (as different from English) is missing.

A serious error has crept in on page 37. Content is *der* Gehalt the plural of which is die Gehalte. But *das* Gehalt with the plural die Gehälter means salary.

W. GRAEFE,

**Handbook of Earth-moving Machinery.** Published by Central Water and Power Commission, Government of India, 1951. Pp. 274. Price Rs. 8.

Nowadays earthen bunds are designed for much greater heights than formerly and the quantity of earth to be handled is enormous. If the work is to be done by ordinary manual labour, the labour force to be employed will be great and time required will also be considerable. The adoption of earth moving and earth handling machinery for earthen dams and channel excavation will no doubt be a great saving in time and labour.

The subject is divided into eight chapters. Chapter One deals with the machinery needed in dam construction. The equipment used in Hirakud Project, one of the big river valley projects is dealt with and the several problems met with there is very useful. Chapter Two deals with the project planning and principles governing the selection of earth-moving machinery. Chapter Three gives the details of earth handling and moving machinery and Chapter Four gives the details of prime movers required. The Chapter on maintenance and upkeep of the several earth-moving and earth-handling machinery is very instructive and every one who has something to do with the equipment should know it. The last two chapters deal with equipment of repair shops and training for the operators.

The book has been published at the most opportune moment and each Engineer and every technical library should possess the same.

K. SEETHARAMIAH.

**The Terpenes. Vol. III.** By Sir John Simonsen. (Cambridge University Press, London), 1952. Pp. xi + 579. Price 50 sh. net.

The chemistry of terpenes is so very attractive a field of study that it can never fail to give surprises. There are at present more than 260 essential oils for which descriptions are available and the number of substances isolated and studied are so numerous that the appearance of the two volumes on terpenes in 1932 was an event of extreme importance. The reviewer had the good fortune to be allowed to read the manuscripts of the first two volumes as they were going to the Press and feels it a pleasure to write this review.

Sir John Simonsen has presented the subject-matter of the eleven chapters of the present volume with clarity, and reading through

these chapters is an intellectual pleasure. The volume is not a mere collection of facts but a clear exposition of the facts that have arisen during the course of investigations of the molecular marvels of the sesquiterpenes and diterpenes. The sesquiterpene section deals with forty-two individuals of known constitution and twenty of unknown constitution. The diterpene section deals with twenty-seven substances of known and three of unknown constitution. All this enormous volume of work is concisely and precisely dealt with in 480 pages. Then follows 41 pages of addenda to Volumes 1 and 2.

In recent times much attention has been devoted to the study of the higher boiling fractions of many essential oils containing the azulenic hydrocarbons. It is of extreme importance to remember that the conversion of linear sesquiterpenes to naphthalenes can follow, subject to the isoprene rule, three paths and the products terminated by two paths (cadalene and eudesmol types) alone have been found in nature so far. An analogous ring formation leads to nine possible azulenes. Eighty-seven members, including derivatives, of the azulene group have so far been recorded. The present volume deals with the chemistry of Guaiazulene (S & Se) and vetivazulene, two of the best established members of the group.

In a short review it is not possible to cite all the outstanding merits of the volume. Sir John Simonsen has contributed much to our knowledge in this field by his outstanding classical researches and those who carefully read through this volume will discern the author's critical appreciation of the work of various contributors in the field. For those who want to begin the study of the subject and for those who take up work in the sesquiterpene and diterpene fields, there can be no better book for helpful guidance and ready reference. The printing and get-up of the book maintains the high traditions of the Cambridge University Press.

K. N. M.

**Management and Conservation of Vegetation in Africa: A Symposium.** Bull. No. 41 of the Commonwealth Bureau of Pastures and Field Crops. Penglais, Aberystwyth, Wales, 1951. Price 10 sh. 6d.

The present bulletin is one of the series planned for different continents by Dr. R. O. Whyte and the Director of the Commonwealth Forestry Bureau to indicate how much the

conservation of soil and the proper management of the land can lead to the conservation of vegetation and greater fertility of the soil. It is a pity that this should be the only bulletin to be issued of the planned series for when completed it would not only give us a survey of the measures so far adopted in different countries of the Commonwealth but would help one another. They would also open the eyes of the Governments to the urgent need and the benefits to be derived from vegetation surveys, mapping and the resultant economic and agricultural applications of them.

The Bulletin consists of seven articles covering the whole of British Africa and surprisingly no reference is to be found to the very valuable work done in the same direction in the French and Belgian Congo. An additional article on the work in these countries would have added to the value of the present bulletin and shown us what type of work is being carried out in countries outside the Commonwealth. Let us hope that some day this information is made available to us in a separate bulletin giving us information which is scattered in several articles and journals in French and Belgian.

Let us hope that this Bulletin will reveal to Indian scientists how much work lies ahead of us and that it is high time that concerted efforts are needed to collate all the existing information on the major problems that face us to-day like the "grazing and fodder resources". In an agricultural country like India, the problem of grassland improvement should have been taken up on an intensive basis long ago but we find ourselves instead on the threshold of it. This bulletin, therefore, should act as a stimulus and an eye-opener to the backward nature of our country in the matter of vegetation and soil conservation.

F. R. B.

**Literature Review on Fats and Oils, 1950.** By the Vanaspati Research Advisory Committee, C.S.I.R., and the Nutrition Advisory Committee, I.C.M.R. (Published by C.S.I.R., New Delhi), 1952. Pp. 28.

This is the second publication in the above series. The review gives a comprehensive summary of the results of important developments in the field of fats published in Indian and foreign journals during the year 1950. The subject has been divided for convenience in reading under appropriate headings, namely, production, trade, composition, synthesis, technology and processing, keeping quality, uses,

nutritive value and analysis of fats and fatty products. Considering the difficulty generally experienced in obtaining technical journals at one centre the reviewer has done a creditable job. A chapter on prices, and a contents page could have been added with advantage. The review should prove very useful to workers in the many fields in which fats and their derivatives play such an important role. The printing and arrangement of the matter have been done with considerable care. Early appearance of the next instalment in the series will be looked forward with eagerness.

N. N. DASTUR.

**Nuclear Data. Supplement 2 to N.B.S. Circular 499.** (U.S. Department of Commerce, Washington), 1952. Pp. 63. Price \$4.25.

During the last few years, the amount of information regarding atomic nuclei has become very vast and is also spread over in different journals all over the world. The National Bureau of Standards Supplement 1 and 2-Circular 499 on Nuclear Data is an attempt to collect all this information in a classified manner. Supplement 2 (compiled from information available upto January 1951) covers Supplement 1 for all practical purposes and the energy level diagram, etc., given in 1 are omitted and the reader is referred to the very comprehensive review on the subject by Hornyak. *et al.*, "Energy level of light nuclei", *Rev. Mod. Phys.*, 1950, 22, 291. This Supplement contains for each isotope information regarding the total experimental neutron cross-section, the magnetic moment, spin and other facts relating to its radio-activity, if any. The method by which these quantities are measured is given in the next column and the references relating to any particular measurement are clearly indicated in the last column. The book is indispensable to any laboratory engaged in nuclear physics research.

R. RAMANNA.

#### Books Received

**Chemical Activities of Bacteria.** By Ernest F. Gale. (Oxford University Press), 1951. Pp. 213. Price Rs. 7-12-0.

**Genetics of Garden Plants.** By M. B. Crane and W. J. C. Lawrence. (M/s. Macmillan & Co.), 1952. Fourth Edition. Pp. xvii + 301. Price 20 sh.

**Hydraulic Research in the United States.** Edited by Helink Middleton & Sonya W. Matchett. (Miscellaneous Publication No. 201). (U.S. Department of Commerce), 1951. Pp. xi + 190. Price \$1.25.

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## SCIENCE NOTES AND NEWS

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### Three Crops a Year

Sri. A. B. Saran and Dr. R. H. Richharia, Agricultural Research Institute, Sabour, write as follows:

At the Rice Experimental Area, Sabour, two crops of paddy were followed up by one crop of wheat from the same plot. The first crop of paddy was sown broadcast in March and was harvested in June. After the harvest, the plot was prepared and the second crop of paddy was sown broadcast in early July, and harvested in October. The plot was prepared again and an early wheat was sown in November and harvested in March. The following yields per acre were obtained: (i) First crop Sona paddy, 1,074.2 lb. (ii) Second crop: Sona paddy, 1,246.4 lb. (iii) Third crop sown, Wheat No. Br. 319, 984.2 lb.

### Vignan Pragathi

A new monthly Research Information Bulletin in Hindi, entitled *Vignan Pragathi*, has been started by the Council of Scientific and Industrial Research, New Delhi. The first issue, released on August 15, 1952, contains articles on planning for cottage and small-scale industries and the National Physical Laboratory. The Notes and News Section gives outlines of processes for the preparation of castor seed oil through aqueous extraction, milk and curd from groundnut kernel, essential oil from costus roots, silage from leaves shed by trees during autumn, and borax-free enamel compositions. The patents section gives details of a new charkha capable of spinning multiple yarns and the preparation of active carbon from groundnut husks. A glossary of technical terms used in the issue is given at the end of the number. (Annual Subscription Rs. 5. Single copy As. 8).

### Indian Association for the Cultivation of Science

Presenting the annual report of the Council for the year 1951-52, Prof. P. Ray, the Honorary Director, stated that this was the first report of the activities of the Association in its new buildings at Jadavpur. The process of shifting and setting up of equipment and apparatus in the new building naturally shortened the productive period of research work during the year. With the concerted efforts of all con-

cerned, however, the setting up of the laboratories was completed fairly quickly, and most of the laboratories were able to resume their activities before long.

The following are the office-bearers for 1952-53: *President*: Dr. J. C. Ghosh. *Vice-Presidents*: Dr. D. M. Bose, Prof. M. N. Saha. *Hony. Director*: Prof. P. Ray (*Ex-Officio*).

### Kalinga Prize, 1952

The UNESCO has requested a nomination for the 1952 award of the Kalinga Prize for the popularisation of science from the Association of Indian Science Writers and has desired that it should be accompanied by at least 4 copies of the various works of the candidate, either copies of his books or reprints of his articles, if possible. Persons desiring AISW nomination are requested to send copies of their books and articles to the Secretary, Association of Indian Science Writers, c/o *Science & Culture*, 92, Upper Circular Road, Calcutta-9, by the end of August, 1952.

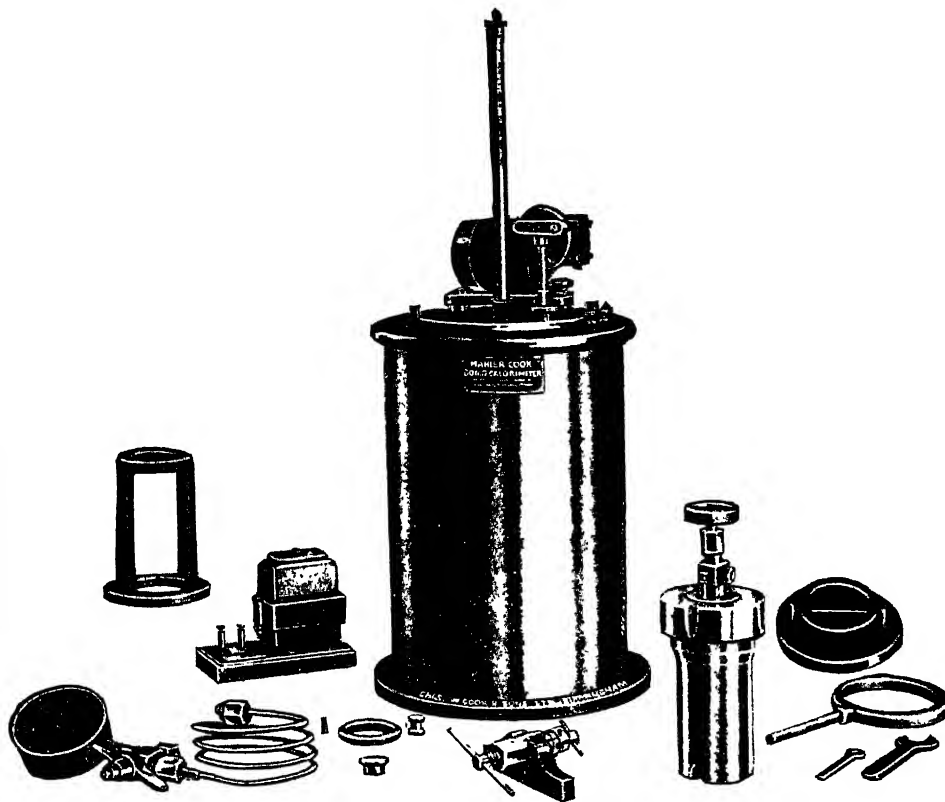
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### Award of Research Degree

On the recommendation of a Board of Examiners consisting of Prof. R. Courant, Prof. A. Zygmund and Dr. Otto Szasz, the thesis entitled "Eigenfunctions of the Membrane Problem" by Sri. P. Sambasiva Rao, has been declared qualified for the Degree of Doctor of Science in Mathematical Physics of the Andhra University.

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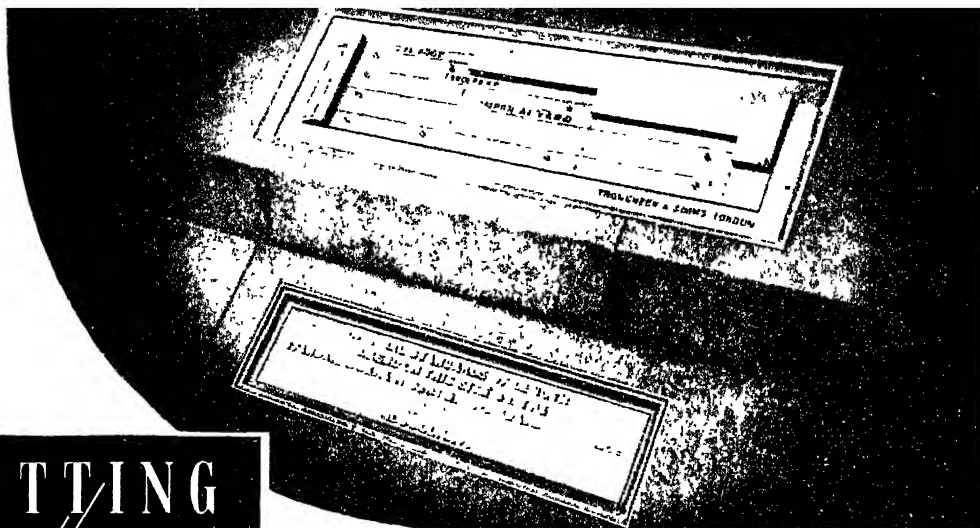
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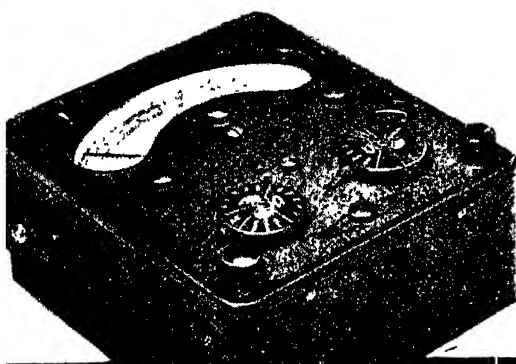
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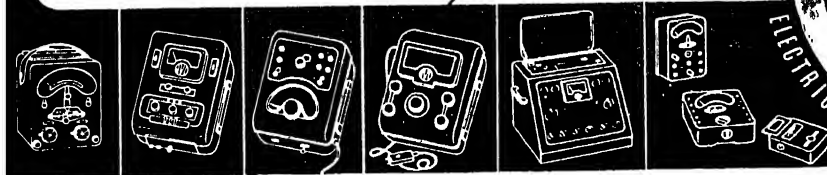


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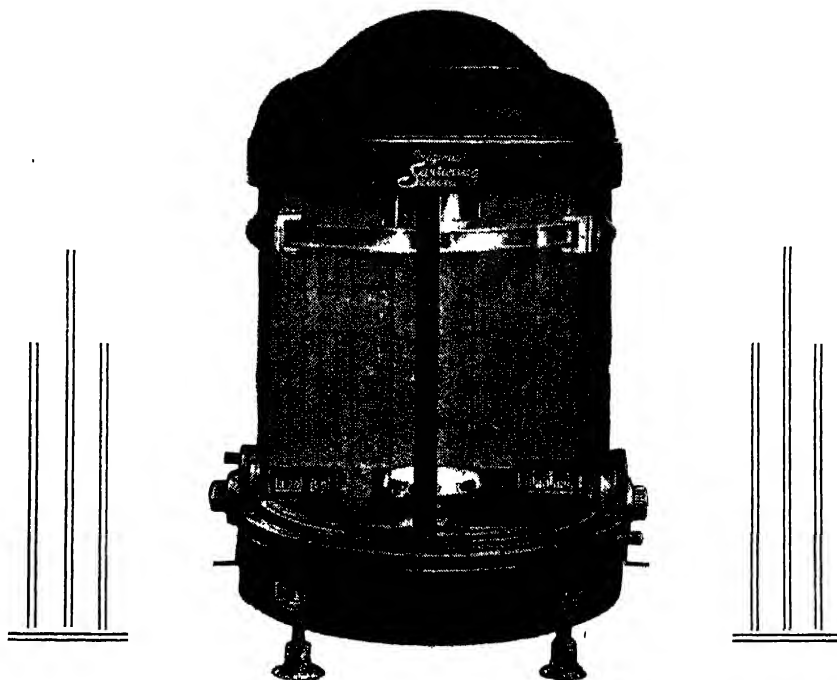
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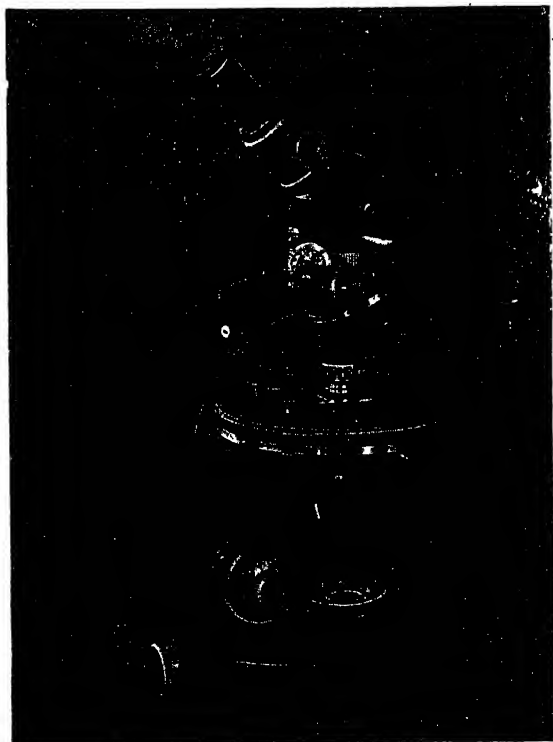
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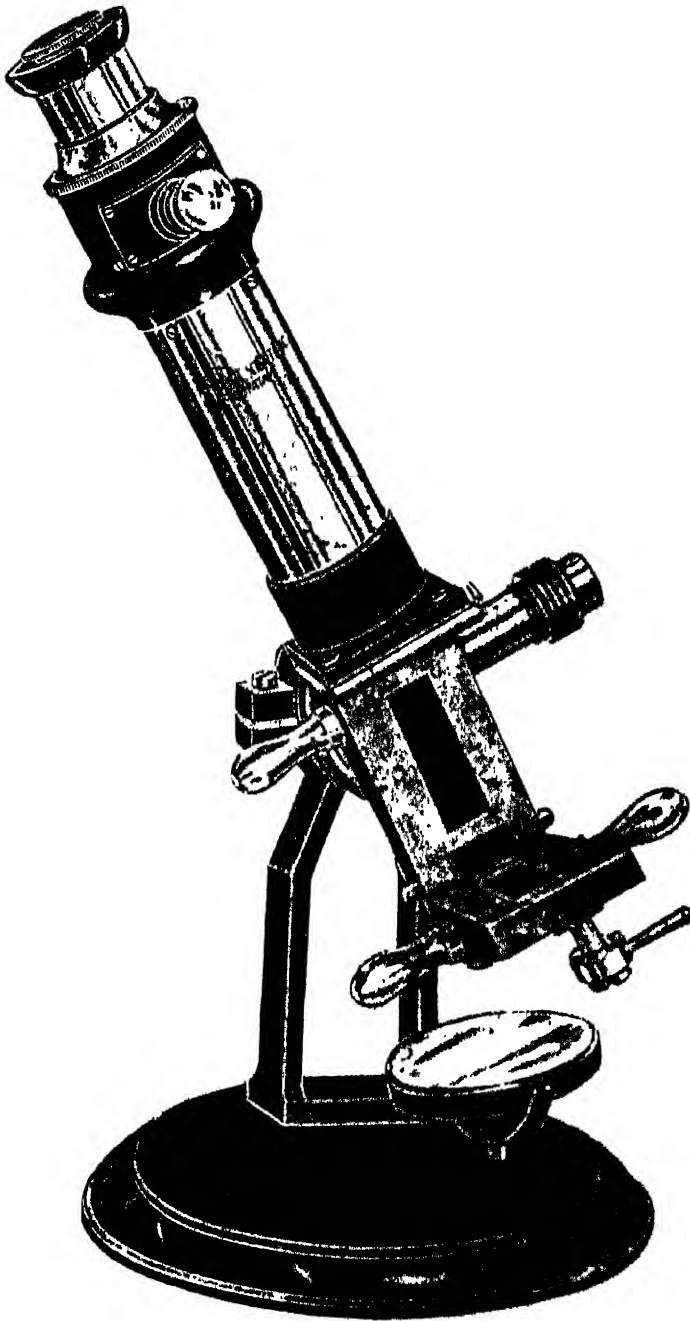
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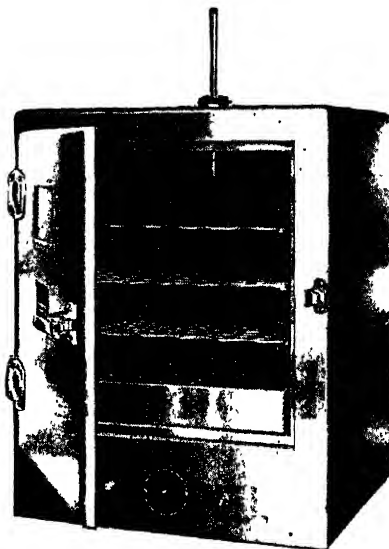
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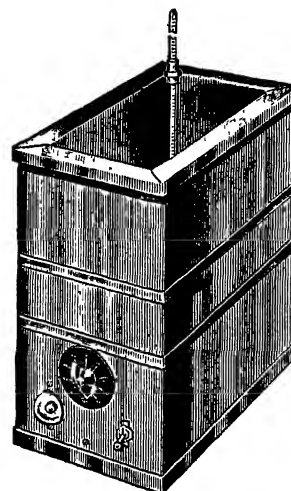


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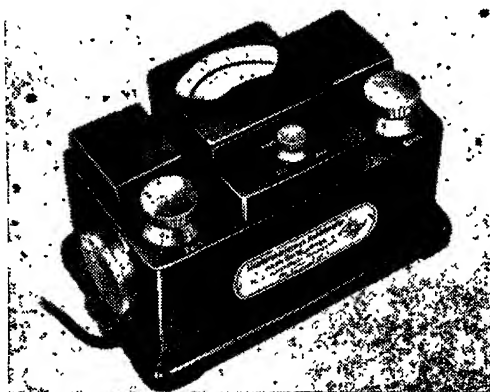
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## POPULARISATION OF SCIENCE

IN the words of Prof. de Broglie, the dissemination of scientific knowledge among non-specialists has to-day become a very important and delicate problem; very important because it is essential that public opinion at all levels should be able to understand the scope of scientific progress, its intellectual value and the tremendous repercussions which it can have on the future of our civilisation, and very delicate because scientific knowledge is each day becoming more extensive and more complex so that it is very difficult to make its meaning comprehensible to the general public without an unfortunate distortion of some of its aspects.

It may no doubt be that the delicacy of the problem arises because of its importance, but judging from the standards of perfection achieved in this direction so far by such great names in the field of science as Faraday, Sir James Jeans, Bertrand Russell, J. B. S. Haldane, Louis de Broglie, and Sir C. V. Raman in our own country, the situation may indeed be regarded as hopeful rather than otherwise.

In this connection it may perhaps be necessary to point out the bearing which the popularisation of science has on the growth of science itself. The domains of any one branch of science such as spectroscopy have been rendered so vast by the great and rapid strides of progress that a specialist in it finds himself after some years unable to follow the developments in some such other branch as biochemistry. This is in-

deed to be considered as very unfortunate since a progressive intermingling—cross-fertilisation as it were—of the various disciplines is becoming more and more a condition necessary for growth and progress.

Reduced to its fundamentals, popularisation of science is a matter of choosing the words known to the common man but using them in a special sense so as to take him over to the domain of knowledge he is a stranger to. This is in sharp contrast to the way usual with specialists of inventing a new word rather than extending the use of the known one. This tendency is quite understandable because the specialist has other business than being the full-fledged literary scientist such as popularisation of science might demand. There is no doubt that the use of specific technical terms with a precise significance attached to each of them has its own advantages; but it will be a wonder if it should not create difficulties, especially when it becomes unmanageably large as at present and when the same term might have entirely different meaning in different branches of science. This is where we believe popularisation of science has a most significant part to play, viz., to enable the specialist to keep down the number of technical terms to the indispensable minimum and to evolve a vocabulary common to a number of allied branches. If we may hazard a guess, the greater the importance assigned to popularisation of science,

the greater will be the chances for the progressive intermingling of the various branches and for the cropping of such disciplines as cybernetics and biophysics.

There have, of course, been historical reasons why popularisation of science has not yet come into its own in our country, but it is to be hoped that the matter will receive more serious attention from all quarters in the future. It is a welcome sign that the Kalinga Prize for the popularisation of science should have been instituted by an Indian; even more welcome is the formation of an Association of Scientific

Writers in India for the same purpose. But we feel that the active co-operation of our industrialists, the press and the Government of India will be needed for the establishment of Journals of the type of *Scientific American*, not only in English but in almost every regional language. The part to be played by our leaders of science in the various branches is also considerable: they may not rest on their laurels unless they make it an integral part of their scientific programme to enable the common man to take an intelligent interest about what they are after.

### PLANNING OF SCIENTIFIC RESEARCH IN RELATION TO NATIONAL RECONSTRUCTION

IN the course of his Acharya Profulla Chandra Ray Memorial Lecture, Dr. K. G. Naik, Rector of the Gujrat University, observed:

The U.S.S.R. has surpassed all other countries in the co-ordination of scientific research, by organizing three kinds of institutes, namely, (i) The Main Institute undertaking industrial as well as pure fundamental research work, in connection with the problems passed on to them by (ii) The Branch Institutes which, in their turn, test, on a semi-manufacturing scale, the results of research arrived at by the Main Institutes and then only they pass them on to (iii) The Subsidiary Institutes which are the ones directly in touch with agricultural farms, factories, mills, etc.

Here is something which India should pause to study and translate into practice. No research worker should be allowed to do what he likes, when India is facing a plethora of problems in industry, agriculture, health, social psychology, social economies, etc. The country

should plan out schemes for research, as based on its socio-economic needs. To work out the solutions of problems immediately facing the country, all the scientific research institutions as well as trained scientific man-power must be well organised all over the country, with a view to putting into practice what has already been discussed, or improving old methods or replacing them by new ones.

According to one of the members of the Cultural Mission which recently returned from China, most of the scientific and technical institutes in China are concentrating on practical applied work of immediate urgency and interest. There appears to be some liaison agency between the Government and the institutes whose job it is to sift out immediate practical problems for research and pass these on for investigation by the institutes. The advantages of a similar co-ordinating agency in India, linked perhaps to the Planning Commission, can hardly be exaggerated.

### PROF. G. I. FINCH

PROF. G. I. FINCH, F.R.S., has been appointed by the Council of Scientific and Industrial Research, India, as Director of the National Chemical Laboratory of India, Poona, in succession to Prof. J. W. McBain, F.R.S., who has just retired.

Prof. Finch has had a long and distinguished academic career and his researches have ranged over many fields. Under the late Prof. Bone's influence he first turned towards the efficient use of coal and its by-products, safety in mines and catalytic combustion, and these interests were reflected in his early researches on the ignition and combustion of gases. His recognition of the vital role played by surface structure in heterogeneous catalysis led him to the

study of surfaces by electron diffraction, a technique with which his name is internationally associated, and which he has applied to the examination of a wide range of chemical and physical problems. This work was recognised by his election to the Francqui Chair in the University of Brussels in 1937-38 and, in conjunction with his important fundamental work on the electrical ignition of gases, by the award of the Hughes Medal of the Royal Society in 1944.

As Director of the NCL, Professor Finch will find ample opportunity to pursue his many interests in the field of applied chemistry to the advantage of Indian economy.

# PETROGEOMETRIC INTERPRETATION OF A CRUSHED CONGLOMERATE FROM RANGAMATIA, SINGHBHUM DISTRICT, BIHAR

PRITHWISH KAR AND UDAY NARAYAN SARKAR

(Department of Geology, University of Calcutta)

CLOSE to the village Rangamatia ( $22^{\circ} 45' 30''$ :  $86^{\circ} 02'$ ; 73J/1) and for some considerable distance strikewise to the east and west of the village, an impersistent band of quartzite runs parallel to the main thrust zone of Dunn and Dey.<sup>1,10</sup> At Rangamatia the strike is NW-SE, which changes to a nearly E-W direction westwards of Rangamatia. Dips are northerly. Lying close to the thrust zone, about 3 to 4 furlongs to its north, the band is made up of a number of small, detached exposures—as many as 18 of these being noted around Rangamatia. The majority of the exposures lie within chlorite-talc-schists and a few within a tongue of schistose soda-granites. Amongst the associated rock types, the closest to the quartzites in affinity are chlorite-mica-schists.

To the east and south-east of Rangamatia, three of the exposures are seen to consist of ellipsoidal pebbles of quartz cemented together in a matrix of quartz, magnetite, hydrous iron-ores, sericite and biotite. The long axes of the pebbles exhibit a certain degree of preferred orientation. The trend and inclination from the horizontal of 100 long axes of the pebbles selected at random were measured. The long axes were determined by actually measuring all the three axes of each selected pebble. It was observed that the dominant trend of the

varying from  $15^{\circ}$  to  $38^{\circ}$ . The axes were plotted on an equal area net, the diagram (Fig. 1) indicating a very well-developed point maxima. This marked lineation of the long axes was, therefore, chosen as the b-axis of the megascopic fabric. The flattened surfaces of the pebbles were found to lie statistically parallel to the *ab*-plane.

Quartz-axes diagrams, both selective and non-selective, were prepared from sections cut parallel to the *ac*-plane in different specimens. The texture of both pebbles and matrix was cataclastic. A non-selective quartz-axes diagram of 100 grains indicated a minor concentration around *b*, and a sharply separated, well-developed *ac*-girdle (Fig. 2). The lineation when

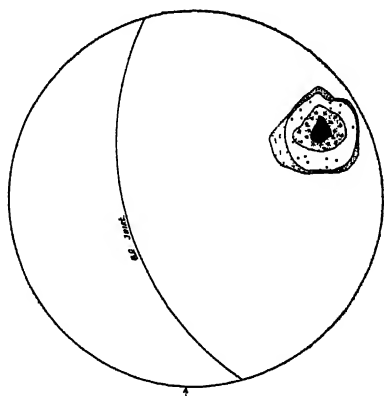


FIG. 1. Axes of lineation—100 ellipsoidal pebbles  
Contours:—0.5-2.5-25-60%

(Maximum concentration 86 % per 1 % Area)  
long axes was  $60^{\circ}$ , with a maximum deviation of  $5^{\circ}$ . All the axes were further found to be inclined towards  $60^{\circ}$ , the amount of inclination

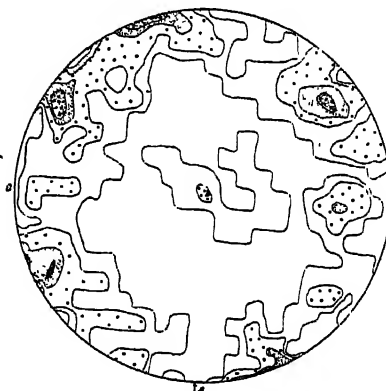


FIG. 2. (Non-selective) 100 Quartz grains  
Contours:—0.5-1.5-3.5-5-10%  
(Maximum concentration 7 % per 1 % Area)  
Specimen No. A/29

interposed on the diagram, very nearly coincided with the axis of rotation of the girdle (*b*), proving that the choice of the fabric axis was correct. Selective quartz-axes diagrams of 50 grains out of a pebble (Fig. 3) and of 100 grains from the matrix (Fig. 4) also exhibited similarly patterned diagrams.

Comparison of Figs. 2, 3 and 4 revealed that the concentration around *b* was much less pronounced (about only 1.5% per 1% area) in Fig. 2 (Specimen A/29) than in Figs. 3 & 4 (Specimen OR/9—about 5.5% and 17% per 1% area respectively). The pebbles were less in number and of much smaller dimensions in Specimen A/29 than in OR/9. Another non-selective quartz-axes diagram (Fig. 5) of 150

grains prepared from Specimen OR/11 revealed a total absence of concentration around *b*. There were well-marked maxima about *a* instead. In Specimen OR/11, there were no pebbles at all but a strongly developed lineation.

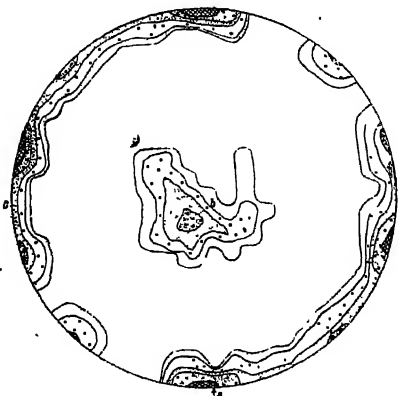


FIG. 3. (Selective) 50 Quartz grains of a pebble only  
Contours:-0.5-1.5-3.5-5.5-7.5%  
(Maximum concentration 10% per 1% Area)  
Specimen No. OR/9

Diagrams 2-4 suggested that the resultant fabric of the conglomerate was produced by the simultaneous rolling of the pebbles together



FIG. 4. (Selective) 100 Quartz grains from the matrix only  
Contours:-0.5-1.5-3.5-5.5-7.5-10.5% (Maximum concentration 17% per 1% Area) Specimen No. OR/9

with the matrix parallel to the *b*-axis, giving rise to the peripheral *ac*-girdle. Such rolling might have been brought about by interplanar slips parallel to the *ab*-plane, thereby flattening the pebbles parallel to *ab*. The rolling might presumably have caused further, a concomitant elongation parallel to *b*. The retention of the fine-grained cataclastic texture by the conglomerate would point to the absence of any *para*- or post-tectonic recrystallisation. The maxima around *a* in Fig. 5 in

place of the usual maxima around *b*, implied that in the presence of the pebbles, the rolling of the parent rock parallel to *b* not only produced a prominently developed *ac*-girdle, but the '*c*' axes of the ruptured grains drawn out during the elongation of the pebbles parallel to *b* concomitant with such rolling, were concentrated around *b* as well. When no pebbles

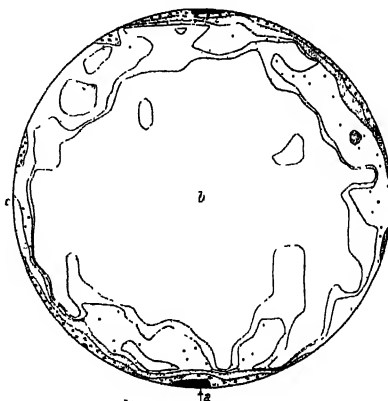


FIG. 5. (Non-Selective) 150 Quartz grains  
Contours:-0.5-1.0-3.0-6.5-13% (Maximum concentration 18% per 1% Area) Specimen No. OR/11.

were, however, present to exercise such a control, the grains ruptured during the deformation were naturally concentrated around *a*, due to forward rolling, thus producing Maxima 1. In other words, the pebbles are not the products of cataclastation of the parent rock; but were present originally as a textural variant in the arenaceous parent material. It is worthwhile to note here that Specimen OR/11 was obtained from an exposure only about 450 ft. away (dipwards) from the exposure which yielded Specimen OR/9.

The trace of a well-developed set of joints, dipping 60° towards 288° was plotted on Fig. 1. These joints, at right angles to the lineation are typical *ac* tension fractures. There is another feebler set trending nearly E-W (106°). Milky-white quartz veins were seen to infill and also cut across these joints.

The authors are indebted to Sri. S. Sen of the Department of Geology, Calcutta University, for helpful guidance in the interpretation of the data, and to the Director, Geological Survey of India, and the Director, Indian Bureau of Mines, for permission to publish the paper.

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## RAMAN SPECTRUM OF CARBORUNDUM

CARBORUNDUM crystals are known to exist in five different forms,<sup>1</sup> four of which belong to the hexagonal class and the remaining one cubic. Because of the simplicity of its structure this substance offers scope for a detailed study of its vibration spectrum. Consequently, a preliminary study of its Raman spectrum was made by the writer nearly a year ago and it has not been possible since then to pursue this study further. For this investigation a thin transparent plate of carborundum was placed at the disposal of the writer by Prof. C. V. Raman to whom the author's grateful thanks are due. Using the  $\lambda 4358$  radiation of a mercury arc as exciter and a Hilger two-prism spectrograph of high light gathering power, its

Raman spectrum was recorded. The spectrogram, though faint, revealed the existence of a fairly sharp Raman line with a frequency shift of  $818 \text{ cm}^{-1}$  and a few feebler ones in its neighbourhood. The sharp line may be assigned to the fundamental mode in which the carbon atoms oscillate against the silicon atoms. The frequency shift of this line is found to correspond with the strong infra-red reflection maximum at  $12\mu$  reported by Schæfer and Thomas<sup>2</sup> in one of the hexagonal forms of carborundum. An examination of the optical properties of the specimen used by the writer showed that it is also of the hexagonal class. From the known symmetry of carborundum, this coincidence between the infra-red maximum and the Raman line is only to be expected, even if the form of the specimen used

by the author is different from that employed by Schaefer and Thomas.

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1. Ott, H., *Zeits. f. Krist.*, 1925, **61**, 515; **62**, 201;  
1926, **63**, 1. 2. Schaefer and Thomas, *Zeits. f. Phys.*,  
1928, **12**, 230.

### SPECTRAL STUDIES OF OZONISER DISCHARGES IN NITROGEN

THE spectrum of an ozoniser discharge at voltages from 800 to 6,000 in pure stagnant nitrogen at 20 mm. pressure is characterised by the presence of a large number of band systems of the nitrogen molecule. Extended exposures of over 60 hours do not record, even as traces, any one of the NO bands. The following Table contains a complete list of band systems and bands and lines obtained in these experiments. The intensities are visually estimated relative values. In the case of band systems, they represent the intensity of the strongest band of the system recorded.

Bands	$r_e$ in the initial state (cf. Rosen and Herman)	Intensity
<i>Triplet systems :</i>		
2nd positive ..	1.2123	100
4th do ..	1.108 ( $r_0$ )	30
1st do ..	1.293	0.5
<i>Singlet systems :</i>		
P system ..	1.12 ( $r_0$ )	40
Q do ..	1.32 ( $r_0$ )	20
S do ..	(1.27)	20
R do ..	1.20 ( $r_0$ )	20
S do ..	1.23 ( $r_0$ )	20
T' do ..	1.22 ( $r_0$ )	20
$\theta$ do ..	..	2
2839 and 2980 A ..	..	15
2462.3, 2567.5, 2679.7 and 2810.6 A ..	..	1
2723 and 2852.4 A ..	..	10
Kaplan's 2nd system ..	1.16 ( $r_0$ )	15
5th positive or Van der Ziel's ..	1.18	5
<i>N<sub>2</sub><sup>+</sup> system</i>		
1st negative ..	1.075	60

In addition to the above, the following lines and band heads due to trace impurities have been recorded on long exposure plates, with intensities ranging from 10 to 20 on the above scale: 2883 and 2896 A due probably to CO<sub>2</sub><sup>+</sup>, 3064 A due to OH, 2536 A due to Hg.

#### Unclassified bands :

2417.9, 2424.0, 2459.6, 2612.0, 2673.0 and 2907.5 A  
 $r_e$  in the ground state, X<sup>1</sup> $\Sigma_g^+$ , 1.094

The characteristic features of the spectra are :

(a) Among the triplet systems, the second positive is the strongest with the fourth positive as the next best. The first positive system

is extremely weak. While an exposure time of 2 hours brings out all the bands of the second positive system on a small quartz Hilger E<sub>1</sub> spectrograph with the usual slit width of 0.02 mm., only a faint impression of three groups of the first positive system at 5850 A, 6200 A and 6600 A, is obtained in 24 hours with a slit width of 0.22 mm., other factors being strictly the same. No other system is recorded.

(b) Among the singlet systems involving transitions to  $a^1\pi_u$ , seven out of the eight known systems (Gaydon and Herman, 1946) are excited simultaneously, whereas some of these systems are known to be selectively excited under special conditions of excitation and discharge (Rosen and Herman, 1951) like the luminescence discharges, discharges in the presence of rare gases and through nitrogen at moderate but controlled pressures and mildly condensed hollow cathode discharges through flowing nitrogen at a few mm. pressure. The single progression of bands at 2839 A and 2980 A, recorded by Janin (1949), is obtained; in addition, there are two more progressions which also probably involve transitions from new initial electronic levels to the  $a^1\pi_u$  state.

Among the electronic levels that are excited, there are many in which the internuclear distance is much different from that in the ground state of the molecule. This indicates that under the present conditions of discharge, excitation of spectra is brought about not only by electron collisions but also appreciably by atomic and ionic collisions. This view is further borne out by observations based on microphotometer traces of the first and second positive bands. These show: (1) Among the groups of bands excited in the first positive system, the group at 5850 A ( $\Delta v = 4$  sequence) is stronger in intensity than that at 6600 A ( $\Delta v = 3$  sequence). The relative intensity distribution is thus similar to the one obtained in the afterglow spectrum (Johnson, 1949) or the positive column discharge through nitrogen (Pearse and Gaydon, 1950) wherein ions and metastable atoms play a significant part in the excitation of spectra. (2) The relative intensity distribution of the (0, 1), (0, 2) and (0, 3) bands of the second positive system resembles more or less the one obtained in the positive column discharge in air (Tawde, 1934).

The abnormally low intensity of the first positive bands in this type of ozoniser discharge is probably due to deactivation of the excited emitters in the electronic level, B<sup>3</sup> $\pi_u$ , by collisions (Gaydon, 1944; Tawde and Patankar, 1944) and by possible radiationless transfer to repulsive states (Kaplan, 1931; Okubo and Hamada, 1932) in the manner suggested by Zener (1933).

Details are submitted for publication elsewhere.

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Banaras Hindu University,  
June 4, 1952.

1. Gaydon, A. G., *Proc. Phys. Soc.*, 1944, **56**, 85. 2. —, and Hernan, R., *Ibid.*, 1946, **58**, 292. 3. Janin, J., *Science Abstracts*, 1949, **52**, 737. 4. Johnson, R. C., *An Introduction to Molecular Spectra* (Methuen & Co.), 1949, p. 44. 5. Kaplan, J., *Phys. Rev.*, 1931, **37**, 1409. 6. Okubo, J. and Hamada, H., *Ibid.*, 1932, **42**, 795. 7. Peirce, R. W. B. and Gaydon, A. G., *The Identification of Molecular Spectra* (Chapman & Hall, Ltd.), 1950, p. 363 f. 8. Rosen, B. and Herman, R., *Constantes Selectionees Donnees Spectroscopiques Concernant les Molecules Diatomiques* (Hermann & Cie, Depositaires, Paris-Ve), 1951, p. 199 f. 9. Tawde, N. R., *Proc. Phys. Soc.*, 1934, **46**, 324. 10. —, and Patankar, V. S., *Phil. Mag., Ser. 7*, 1944, **35**, 616. 11. Zener, C., *Proc. Roy. Soc., A*, 1933, **140**, 660.

## REFRACTIVITY OF ORGANIC VAPOURS

EMPLOYING the method described in a previous communication,<sup>1</sup> the refractivities\* of some liquid vapours were determined using the Rayleigh refractometer. The observations were made at the room temperature and the refractivities were reduced to N.T.P. by means of the formula  $n_0 - 1 = (n - 1)v$ , where  $v$  was calculated from Berthelot's equation taking the necessary constants from I.C.T.<sup>2</sup> The results are given in Table I with a probable error less than 0.25%.

TABLE I

No.	Substance	Temp. °C.	Vapour pressure mm.	$(n - 1) \times 10^6$	$(n_0 - 1) \times 10^6$
1	Benzene	27.4	105.2	243.1	1917
2	Carbon tetrachloride	28.8	135.5	296.6	1821
3	Cyclohexane	33.4	139.0	318.5	1935
4	Methyl acetate	30.7	273.8	397.1	1209
5	Methyl alcohol	30.5	162.1	108.6	564

The refractivity of cyclohexane vapour does not appear to have been determined previously. For the rest, the values of  $(n_0 - 1)$  given here are generally somewhat higher than the cor-

responding values given in I.C.T.<sup>3</sup> which are, however, in some cases, given with reserve.

Also the variation of the refractivity of saturated vapours with temperature was studied and compared with what may be expected from theory. Applying the ideal gas laws to the vapour, Gladstone and Dale's Law may be written in the form  $(n - 1)T/p = \text{constant}$ , which on differentiation yields

$$\frac{1}{p} \frac{dp}{dT} = \frac{1}{T} + \frac{1}{n - 1} \frac{d(n - 1)}{dT}$$

The left hand side was evaluated from vapour pressure data given in I.C.T.,<sup>4</sup> and the right hand side from refractivity measurements. The results are given in Table II. It is seen that there is agreement within 1.7%.

TABLE II

No.	Substance	$T$ (° K)	$(n - 1) \times 10^6$	$\frac{d(n - 1)}{dT} \times 10^6$	$\left[ \frac{1}{n - 1} \frac{d(n - 1)}{dT} + \frac{1}{T} \right] \times 10^{11}$
1	Benzene	301.5	253.1	10.52	44.90
2	Carbon tetrachloride	302.8	308.1	12.30	43.22
3	Cyclohexane	307.8	335.7	12.66	40.98
4	Methyl acetate	305.5	423.1	15.88	40.80
5	Methyl alcohol	304.7	114.8	5.42	50.44

All the liquids used were Merck's guaranteed reagents except cyclohexane which was obtained from Kodak.

The author is thankful to Prof. M. Ramana-  
dham for his interest in this work.

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\* For the mean D line.

1. Venkataraman, S., *Curr. Sci.*, 1952, **21**, 156.
2. *International Critical Tables*, 1928, **3**, 248.
3. *Ibid.*, **7**, 10.
4. *Ibid.*, **3**, 215-27

## GRANULAR STRUCTURE IN ROCK SECTIONS AND TRANSMISSION OF SOUND

In the course of a detailed investigation on the elastic behaviour of rocks by ultrasonic methods,

the author has come across an interesting result connecting the granular structure of a rock section and the transmission of ultrasonic waves through it. Fig. 1 (a) represents the ultrasonic



pattern obtained after the sound wave is transmitted into a liquid through a limestone section and Fig. 1 (b) is similarly obtained with a granite section. In both cases, the same quartz wedge is the source of ultrasonic waves and the thicknesses and frequencies employed are nearly the same as will be seen from the following data :

	Thickness in m.m.	Frequency m.c./sec.	Velocity m./sec.	Density g./c.c.	$C_{11}$ dynes/cm. <sup>2</sup>
Lime stone	2.590	2.55	6360	2.841	$11.5 \times 10^{11}$
Granite	2.537	2.76	7148	2.732	$13.9 \times 10^{11}$

Care has been taken to keep the power of the oscillator same in both the cases. The photographs clearly show that high frequency sound is transmitted freely through the limestone but largely absorbed, probably by a process of scattering in granite. Granite in this investigation is of the pink variety occurring in Hyderabad State and its texture is inequigranular, the mineral composition varying from grain to grain. On the other hand, the limestone studied, which is from Piduguralla area, is steel black and the section is equigranular. All the grains in the section possess nearly the same mineral composition. A further distinction has been found in that the transmission maxima are sharp in limestone and comparatively broad in granite. The author has investigated a large number of rock sections and the results in practically all of them show that the differences in granular structure are clearly reflected in the differences of sound transmission as studied by the ultrasonic wedge method.

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## ORIGIN OF THE ALKALINE ROCKS OF KISHANGARH, RAJASTHAN

A DETAILED study is here reported of the structural features of an exposure of alkali syenite occurring north-east of Kishangarh, Rajasthan, within the Aravalli metamorphites. These latter consist chiefly of quartzites (biotite and amphibole bearing) with a little amphibolite and calc-granulite.<sup>1</sup> The nepheline syenite appears coarse-grained and is more or less granitoid at the centre of the exposure, the glomeroporphyritic clots of amphibole arranged in linear trends imparting a faint lineation. Outwards, on both sides, a faint foliation is seen to have been developed and at the outermost margin the rock becomes well banded gneissose, more in the nature of a composite gneiss, showing ptigmatic folding and other minor characters that correspond to similar features in the migmatitic granite exposed further east. The dark bands in both these rocks are amphibolites or amphibole-rich assemblages.

The Aravallis have been thrown into a series of folds forming pitching anticlines and synclines arranged *en echelon*. The main mass of the nepheline syenite, besides showing no discordance along its borders, repeats all these structural features faithfully. Even with regard to its lineation it does not exhibit any structural independence. These lead to the conclusion that all the major structural features have been impressed simultaneously in all the rocks of the region, and the structures within the alkaline rocks or outside it are members of the same regional pattern. The granite migmatites are obviously results of post-kinematic granitization and no evidence has yet been obtained which would suggest the existence of a regional polymetamorphism or a second period of diastrophism.

Some local structures, not conforming to the regional alignments, may be ascribed to the volume change accompanying the transformation. Thus, the ptigmatic folds in the granitic migmatites are types of flow structures incidental on the metasomatism, and similar features in the alkali syenites have to be similarly interpreted. Minor displacements along joints, drawing out or rotation of amphibolitic clots and other such features in the nepheline syenite could be produced similarly. These might have been accentuated by viscous flow if the metasomatism had taken place through the intervention of liquids.

The above considerations have led the author to propose tentatively an entirely new mode of



origin for the alkali syenites. The imperceptible passage of the granitoid nepheline syenite, through the foliated to the migmatite variety, taken together with the structural concordance, prove that the rock is a metasomite, transformed *in situ*, and that the group is genetically connected with the associated granite migmatite. The suggestion differs from von Eckermann's in ascribing the metasomatosis to the same agent responsible for the regional granitization rather than to a carbonate magma<sup>2</sup> and also as regards the conclusion that the associated granite, instead of giving place to the alkaline rocks, has been derived simultaneously by a similar process. Culmination of regional diastrophism was marked by entrance of emanations, and in cases where the invaded rocks were more or less pure calcareous (calc-granulites) homogenization towards a granitic composition could not be attained, the silica deficiency could not be made up, and nepheline syenites were formed. Presence of calcite, cancrinite, etc., should be expected in such an event, and the occurrence of calcite-bearing or "carbonatite" dykes could well be explained following Chayes.<sup>3</sup> The lineation in the nepheline syenite, on such premises, is a ghost of the original secondary lineation in the metamorphites.

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March 21, 1952.

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# PIEDMONTITE FROM THE CHAMPION GNEISS NEAR ROBERTSONPET, KOLAR (MYSORE STATE)

AN interesting feature of the petrography of some specimens of the Champion gneiss<sup>1</sup> occurring at its contact with the hornblende schist, near Robertsonpet, is the development of a distinctly pleochroic mineral occurring mostly in conformity with the foliation of the gneiss. Microsections of the gneiss show the porphyroblasts of quartz and feldspar with flakes of biotite in a groundmass which is full of black specks, probably manganese oxide. The quartz porphyroblasts show the original outline and also irregular cracks; but under the analyzer resolve themselves into granules of quartz showing aggregate polarisation, thus resembling the phenocrysts of the original quartz

porphyry or rhyolite. The feldspars are mostly microcline. The pleochroic mineral is now identified as piedmontite on the basis of the following optical characters.

The mineral occurs in radiating aggregates filling veins (Fig. 1) or in isolated patches



Occurrence of Piedmontite in radiating aggregates filling a vein in the champion gneiss near Robertsonpet, magnified  $\times 40$ .

and thus resembles very closely the piedmontite from the Ancient Rhyolite of South Mountain, Pennsylvania (U.S.A.).<sup>2</sup> It has a high relief and shows the following pleochroism:

X = Pale lemon-yellow.

Y = Pale amethyst.  $X > Y > Z$

Z = Pale red.

The birefringence of the mineral, as determined by the Berek's compensator is 0.029. It is optically positive with  $X \wedge C = -5^\circ$  and  $2V = 80^\circ$ , as determined on the Federov's Universal Stage.

Piedmontite has not been so far noticed anywhere in Mysore and this is the first reported occurrence of this mineral. Further chemical and optical investigations are in progress.

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# ISOMERISATION OF THE DARK GREEN CHROMIC CHLORIDE HEXAHYDRATE IN ACETONE, A ZERO ORDER REACTION

In a previous communication, Datar and Kulkarni<sup>1</sup> reported that isomeric transformation of the dark green chromic chloride hexahydrate in aqueous solution is semimolecular.

Chesterman<sup>2</sup> noted the changes in resistance, which increased with time of solutions of the dark green chromic chloride in acetone at  $25.05 \pm 0.05^\circ \text{C}$ . The colour of the solution changed to purple. When changes in resistance are plotted against time, the points lie on a straight line up to about 80% conversion. From these values for two concentrations of chromic chloride, the time required for different fractions of the reaction completed are calculated and shown in Tables I and II. It is seen that

TABLE I  
Concentration of  $\text{CrCl}_3 = 0.001512 \text{ M}$

% Transformation	Time Mins.	$K_0$
10	3.08	0.000049
20	5.4	0.000056
30	7.3	0.000062
40	9.03	0.000067
50	10.75	0.000070
60	12.65	0.000072
70	15.05	0.000070
80	17.45	0.000069
90	17.85	0.000068

TABLE II  
Concentration of  $\text{CrCl}_3 = 0.02818 \text{ M}$

% Transformation	Time Mins.	$K_0$
10	5.77	0.00049
20	8.55	0.00066
30	11.74	0.00072
40	14.77	0.00076
50	17.80	0.00079
60	21.66	0.00078
70	25.59	0.00077
80	29.50	0.00076
90	38.2	0.00066

the reaction takes place with a constant rate, that is,  $x/t$  (or  $K_0$ ) is constant, where  $x$  is the amount of the transformation expressed in gm. mol./litre and  $t$  is time in minutes. This shows that the reaction is of zero order. It is further seen that  $K_0$  is not constant but increases with increase in chromic chloride concentration. When concentration is increased twentyfold,  $K_0$  is nearly ten times greater.

Some other interesting facts which emerge from closer study of the data in the Chesterman's paper are (1) initial specific conductivity of chromic chloride in acetone solution is the same irrespective of concentration; (2) the transformation takes place with a relatively greater speed in acetone than in water. Further work is in progress.

We are grateful to Dr. Syed Husain for kind award of a scholarship to one of us (V. S. S.). We wish to express our sincere thanks to Dr. S. Husain Zaheer for kind encouragement.

Dept. of Chemistry, V. S. SUBRAHMANYAM  
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and

Central Labs. for Sci. & Indust. Res.,  
Hyderabad, Deccan,  
April 30, 1952.

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## THE USE OF AMMONIUM MOLYBDATE AS CATALYST IN THE ESTIMATION OF DICHROMATE

THE hydrogen peroxide-iodide and bromate-iodide reactions are catalysed strongly<sup>1</sup> by ammonium molybdate. The reaction

$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{I}^- \rightarrow 3\text{I}_2 + 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$  is also catalysed by ammonium molybdate as shown below.

25 c.c. of 0.1 N  $\text{K}_2\text{Cr}_2\text{O}_7$ , 10 c.c. of 10 per cent  $\text{NaHCO}_3$ , varying amounts of HCl followed by 25 c.c. of 12 per cent. KI solutions were taken in glass-stoppered bottles. The amount of HCl left over after reacting with  $\text{NaHCO}_3$  in every experiment was more than enough for the reaction. The extent to which the reaction took place in each of the mixtures containing varying amounts of HCl was examined under three different conditions; (a) the immediate reduction with 8 drops of a 10 per cent. solution of ammonium molybdate, (b) the immediate reduction of  $\text{K}_2\text{Cr}_2\text{O}_7$  which took place without catalyst, and (c) reduction after keeping for 5 minutes in darkness without catalyst; (d) titrating with standard thiosulphate solution after making the volume upto 400 c.c.

The results are given in Table I. Instead of the volume of thiosulphate required, the percentage of the dichromate reduced under different conditions has been given in the Table. All the experiments were tried in duplicate and these gave concordant results accurate to

drop of thiosulphate. A perusal of the Table conclusively shows that ammonium molybdate

TABLE I

Volume of HCl (2N) in c.c.	Percentage of dichromate reduced		
	(a)	(b)	(c)
16	78	64	37
17	79	68	93
18	81	75	98
20	95	78	100
22	100	90	100
24	100	93	100
30	100	98	100

acts as a positive catalyst in the dichromate-iodide reaction.

My thanks are due to Professor B. Prasad for suggesting the problem.

Dept. of Chemistry, D. V. RAMANA RAO.  
Ravenshaw College,  
Cuttack,  
May 20, 1952.

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Ed., 624, 630.

#### ELECTROCHEMICAL PROPERTIES OF HYDROGEN CLAYS FROM CONTI- GUOUS BLACK AND RED SOILS FROM BHOPAL

A STUDY of the nature of electrometric titration curves and viscosity-alkali-concentration curves of hydrogen clays isolated from (1) different horizons of a black soil profile at Bhopal in which the lowest horizon was a reddish one, and (2) a surface reddish brown soil from the same locality, was taken up with a view to finding out the possible mineralogical composition of the clay, following the method of Mukherjee and co-workers.<sup>1-5</sup>

*Titration curves, base-exchange capacity and viscosity alkali-concentration curves of the hydrogen clays.*—Electrometric titration of the hydrogen clays from the first two horizons and the reddish brown horizon of the black soil profile with  $\text{Ba}(\text{OH})_2$  indicates a moderately strong monobasic acid character. The last reddish-brown horizon, however, shows stronger acid character than those of the upper two horizon. Similar also is the nature of the titration curve of the hydrogen clay from the surface reddish brown horizon. The base exchange capacities of the reddish brown clays

are higher than those of the black clays as calculated from their titration curves. The figures are given in Table I.

TABLE I

Profile	Horizons	B. e. $\epsilon$ . me/100 g.	pH at inflection
I	0-12"	48	7.7
	12-67"	50	7.9
	260-261"	82	7.8
	(Reddish brown)		
II	0-28"	76.5	7.8
	(Reddish brown)		

The above results indicate that clay complex of black soils and the reddish brown soils are similar in electrochemical character and as shown by the previous workers, the nature of the curve and the high base exchange capacity indicate the presence of montmorillonitic type of mineral.

The viscosity-alkali concentration curve of the hydrogen clays from both the profile and the surface red-brown sample, showed a maximum at about 60 to 70 per cent. of the total neutralisation of the hydrogen clays. This is a characteristic of montmorillonitic type of minerals as has been shown by Mukherjee, *et al.* (*loc. cit.*).

The montmorillonitic nature of the clay complex is also borne out by the chemical composition of hydrogen clays. The silical-alumina ratios of all hydrogen clays vary from 3 to 4 and further there is a fair amount of non-exchangeable Mg (.2 to 1 per cent.) which is strongly indicative of montmorillonite; further these clays also contain an appreciable amount of non-exchangeable  $\text{K}_2\text{O}$ . This may either be due to the existence of any comminuted potash bearing mineral or an illitic mineral in the clay.

The above results indicate that in 'Rugur' or in the black soil, the brown layer which frequently occurs in the B horizon of the black cotton soil profile and also the red-brown soil which occurs frequently in black soil area are genetically of the same origin. The higher base exchange capacity of the clays isolated from the brown layer as compared to the black soils suggest that the brown horizon has weathered more than the black horizon. Mineralogical analysis of the sand fractions of the black and brown soils by Sen and Tamhane in this labo

ratory also indicate less amount of basic minerals present in the brown soil as compared to black soils. This also confirms that the brown soils are more weathered and more mature. From the electrochemical and electroviscous properties of typical yellow (Matassi) and red soil (Bhata) studied in this laboratory by one of the authors (Das), it is clear that all the red and yellow soils contain montmorillonite in their clay complex though they are dominantly kaolinitic in nature, particularly the yellow soil (Matassi) which contains a fair amount of montmorillonite. From this it appears that the black soils on continued weathering gives rise to the brown, yellow and red soils, the montmorillonites decomposing into the kaolinites during the weathering process.

Ind. Agric. Res. Inst.,  
New Delhi,  
April 22, 1952.

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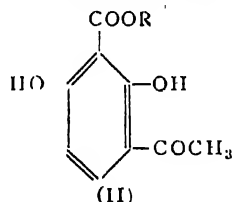
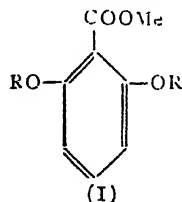
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### THE FRIES REARRANGEMENT OF ISOMERIC ACETOXY-RESORCYLIC ACIDS AND THEIR ESTERS

THE Fries re-arrangement of the acyl esters of  $\beta$ -resorcylic acid and its methyl ester has been investigated by us.<sup>1</sup> We have now extended the above work to the investigation of the migration of isomeric  $\alpha$ - and  $\gamma$ -resorcylic acids and their esters under the conditions of the Fries reaction. The di-acetate of  $\alpha$ -resorcylic acid did not undergo the Fries reaction, only the de-acetylated product being recovered. This observation is in conformity with that of Mauthner;<sup>2</sup> and the non-migration of the acetoxy-acid is analogous to that of *m*-acetoxy-benzoic acid, which does not undergo the migration<sup>3</sup> and is in keeping with its abnormal behaviour in several other reactions.<sup>4</sup>

The di-acetate of methyl  $\gamma$ -resorcylate (I: R = COCH<sub>3</sub>) on heating with anhydrous aluminium chloride at 110° gave a product to which the structure, methyl 2:6-dihydroxy-3-acetyl-benzoate (II: R = CH<sub>3</sub>) has been assigned, as it is hydrolysed to the corresponding keto-acid (II: R = H) which on de-carboxylation gives resacetophenone. The

migration at 150-55° gave only the keto-acid (II: R = H), hydrolysis occurring during the migration. The migration was also investigated under a variety of conditions: the same ketonic product (II: R = H or CH<sub>3</sub>) was obtained. It is interesting to note that only one of the migrating groups occupies a  $\beta$ -position of the resorcinol nucleus, although both of them are free, the other acetyl group being eliminated.



The migration of other acyl derivatives of unsubstituted and diversely substituted  $\gamma$ -resorcylic acids and their methyl esters is under progress.

M. R. Science Institute,  
Gujarat College,  
Ahmedabad,  
June 16, 1952.

N. M. SHAH.  
G. C. AMIN.

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### ANTI-TUBERCULAR ACTIVITY OF SESAMIN

THE following communication deals with the anti-tubercular activity of sesamin,<sup>1</sup> one of the crystalline constituents of the unsaponifiable fraction of sesame (*Sesamum indicum*, Linn. N. O. Pedaliaceae) oil.

In the Yunani system of medicine, the oil is mentioned to be useful for many ailments including dry cough, asthma and diseases of the lungs.<sup>2</sup>

In the present study, while sesamin has shown little activity against the common pathogenic bacteria like *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bact. coli*, and *Bact. typhosum*, it has indicated activity against *Mycobacterium tuberculosis*, even in 1:1,000,000 dilution.

The sesamin for this purpose has been prepared according to the method of Tocher.<sup>1</sup> The procedure in brief is as follows:

The oil is shaken with glacial acetic acid, the acid layer separated and distilled. The thick residue is treated with warm dilute potassium hydroxide, shaken from time to time

and set aside for twelve hours in a conical flask. The supernatant liquid is siphoned off, and the deposited layer of sesamin washed several times with distilled water. It is then boiled with dilute hydrochloric acid, filtered, washed with water, and dried. Sesamin crystallises from alcohol in needle-shaped crystals, m.p. 121° C.

Sesamin in acetone solution is tested for its *in vitro* tuberculostatic activity in Youman's<sup>3</sup> synthetic liquid media using the virulent H<sub>37</sub>R<sub>6</sub> strain (3-4 weeks old) of *Mycobacterium tuberculosis*, by the usual surface growth method.<sup>4</sup> The results at the end of each week for 3 weeks are presented in the Table.

TABLE  
Antitubercular activity of sesamin

Week	Dilution of sesamin in the media						Control with acetone only	Control
	1/100	1/1000	1/10 <sup>4</sup>	1/10 <sup>5</sup>	1/10 <sup>6</sup>	1/10 <sup>7</sup>		
1st	..	-	-	-	-	-	±	+
2nd	..	-	-	-	-	±	+	+
3rd	..	-	-	-	-	+	+	+
- No growth.    + Growth.    ± Slight growth.								

Thus it is seen that the compound has shown very good *in vitro* tuberculostatic activity. The easy availability of the raw material, the easy method of isolation of sesamin therefrom, and its favourable tuberculostatic activity would warrant further investigation of the usefulness of this substance in the treatment of tuberculous infection.

Further work regarding its stability, toxicity and *in vivo* activity is under progress.

Our thanks are due to Dr. K. P. Menon, Dr. M. Sirsi and Dr. A. S. Ramaswamy for their kind interest in the work.

P. R. J. GANGADHARAM.  
N. L. NARAYANAMURTHY.  
B. H. IYER.

Dept. of Organic Chemistry  
and Pharmacology Labs.,  
Indian Inst. of Science,  
Bangalore-3,  
August 14, 1952.

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## A NEW CLASS OF FREE RADICALS

REVERSIBLE thermochromatic behaviour of certain organic compounds<sup>1,2</sup> has been attributed to the formation of free radicals on thermal agitation. But all the systems on record which show such behaviour are known to contain either aromatic nuclei or a disulphide bridge. It has now been observed by us that the absolute alcoholic and acetic acid solutions of the 'bromide' oxidation product<sup>3,4</sup> of tetramethyl thiocarbamide which has been shown to have a monomeric structure and not the disulphide one attributed to it earlier,<sup>5</sup> develop a deep yellow colour on warming, although, the cold solutions are completely colourless. Formation, *inter alia* of Weitz's aminium type<sup>5</sup> free radicals from the above substance has been already suggested by one of us.<sup>6</sup> The reversible thermochromatic behaviour now observed supports this view. The present case is of special interest in view of the completely non-aromatic character of the substance, its saline nature and the observed thermochromasy in partially ionizing media. The detailed paper will be published elsewhere.

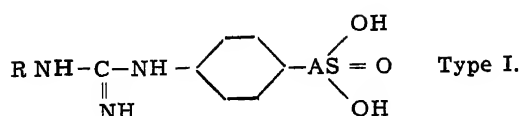
Dept. of Chemistry, R. H. SAHASRABUDHEY.  
College of Science, (Miss) INDUMATI BOKIL.  
Banaras Hindu University,  
April 30, 1952.

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## SOME GUANIDO-ARSENICALS AS POSSIBLE ANTI-MALARIALS

THE use of organo-arsenical<sup>1,2,3,4</sup> drugs in malaria therapy is well known. In our previous communication<sup>5</sup> several biguanido-arsenicals have been reported. When they were tested against *P. gallinaceum* in chicks, they did not show any appreciable activity.<sup>6</sup> With a view to studying the pharmacological properties of guanido-arsenicals, it was considered to be of interest to prepare new compounds containing guanidine residue as also the arsonic acid in the molecule of Type I. The compounds of this type were prepared by reacting *p*-arsanilic acid with the appropriate cyanamides in pyridine medium. After removal of pyridine by steam distillation the products were crystallised from alcohol and characterised.

The following compounds of type I have been synthesised :



Where R = alkyl, aryl or sulphonamides.

No.	R in compounds type I	M.P. ° C.
1	<i>p</i> -Cl-C <sub>6</sub> H <sub>4</sub> -	.. 180 (d)
2	<i>p</i> -Br-C <sub>6</sub> H <sub>4</sub> -	.. 125 (d)
3	C <sub>6</sub> H <sub>5</sub> -	.. 135 (d)
4	CH <sub>3</sub> .C-N	
	$\begin{array}{c} \text{HC} \parallel \\ \text{HC}=\text{N} \end{array} \text{C} \cdot \text{NH} \cdot \text{SO}_2\text{C}_6\text{H}_4-$	Turns black above 300° C.
5	NH <sub>2</sub> -C-NH-SO <sub>2</sub> C <sub>6</sub> H <sub>4</sub> -	150 (d)
6	<i>p</i> -C(H) <sub>2</sub> C <sub>6</sub> H <sub>4</sub> -	.. 160 (d)
7	CH <sub>3</sub> CH-	.. Above 300
8	$\begin{array}{c} \text{CH}_3 \\ \text{CH}-\text{N} \\ \parallel \quad \parallel \\ \text{CH} \quad \text{C}-\text{NH} \cdot \text{SO}_2\text{C}_6\text{H}_4- \end{array}$	.. Turns brown at 223°

The sodium salt of the acids were prepared by the usual way. None of these compounds when tested against experimental malaria have shown any activity.

Full details will be published elsewhere.

Dept. of Organic Chemistry, J. R. GUHA.  
Indian Inst. of Science, S. S. GUHA.  
Bangalore-3, A. C. ROY.  
July 11, 1952. P. C. GUHA.

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### CHLOROPHYLL DEFICIENCY IN STRIGA

*Striga* seedlings deficient in chlorophyll were first seen in the summer (1950) crop of *Cholam* (*Sorghum*) heavily infested with *Striga* at the Millet Breeding Station, Coimbatore. Two such seedlings were observed. One of them with

white leaves, emerged above the ground and then dried up, while the other with yellowish leaves grew to a height of 7 cm. and then dried up completely. A similar experience was met with in the main season of 1951, when two *Striga* seedlings with yellowish leaves were observed. These also grew to a height of about 7 cm. and dried up without flowering. Both types of chlorophyll deficiencies are lethal. The occurrence of mutations for chlorophyll deficiency in crop plants is not uncommon and many instances of such albinos and yellows have been often reported in *Sorghum*, rice, wheat and other cereals. Their occurrence in partially parasitic green plants like *Striga* is rare and the report of such occurrence is made in this paper.

Millet Breeding Station, K. MEENAKSHI.  
Coimbatore, P. KRISHNA RAO.  
May 10, 1952.

### PHARMACOLOGICAL STUDY ON A GROUP OF 4-PIPERIDONE DERIVATIVES FOR THEIR SPASMOLYTIC PROPERTIES

In continuation of our earlier studies on the spasmolytic properties of 3-methyl isoquinoline compounds,<sup>1</sup> the following 4-piperidone compounds were tested for their spasmolytic properties using the same technique. The chemical formulæ of these compounds are given below :

1. 2, 6-di-(2'-methoxy)-phenyl-3, 5-dimethyl-4-piperidone HCl.
2. 2, 6-di-(3'-methoxy-4'-hydroxy-phenyl)-3-methyl-4-piperidone, HCl.
3. 1, 3, 5-trimethyl-2, 6-diphenyl-4-piperidone, HCl.
4. 2, 6-di-anisyl-3-methyl-4-piperidone, HCl.
5. 2, 6-di-anisyl-3-carbethoxy-4-piperidone, HCl.
6. 2, 6-diphenyl-3, 3, 5, 5-tetramethyl-4-piperidone, HCl.
7. 1, 3-dimethyl-2, 6-di-anisyl-4-piperidone, HCl.

Compound 1 in doses of 40 mg. was able to relieve the spasm produced by 0.25 mg. of histamine. Compound 2 in doses of 100 mg. was able to annul the effect of 0.25 mg. of histamine. Compound 7 in doses of 200 mg. was able to relieve the spasm produced by histamine partially. Higher doses could not be tried as the drug was too toxic. This meant that 10 mg. of papaverine HCl equalled 40 and 100 mg. of compounds 1 and 2 respectively for spasmolytic action. But they were not found to be supe-

prior to papaverine in potency, nor had they any effect on respiration.

V. ISWARIAH.

Dept. of Pharmacology, V. S. VENKATA SUBBU.  
Madras Medical College,  
July 12, 1952.

I. Iswariah, V. and Venkata Subbu, V. S., *Curr. Sci.*,  
1952, 21, 131.

### SOLANUM JASMINOIDES VIRUS

A NEW virus has been isolated from *Solanum jasminoides* Paxt. It behaves in many respects like potato virus 'Y' but differs from it in certain important respects. On *S. jasminoides* it usually produces a fleeting type of mottle. By sap inoculation on young seedlings of *Nicotiana tabacum* (White Burley), the first symptoms are a complete and irrevocable collapse of the lower leaves, about 4 to 5 days after inoculation. In another two days' time the vein clearing appears which is followed by appearance of first necrotic specking and later necrotic banding along the veins. The collapse of the leaves is due to extensive phloem necrosis near about and below the collar region of the stem. On *Nicotiana glutinosa* mottling is the only symptom exhibited.

On young plants of *Solanum nigrum* fleeting but distinct vein clearing appears within 7-10 days after inoculation. This is followed by extensive and prominent vein banding. In infected plants the flowers may show very marked structural changes. The normal rotate shape may be transformed into a stellate type with long linear petals. The anther lobes are often reduced and may be represented by small vestige of brownish tissue at the tip of filaments. The disease can also be transmitted by sap inoculation to *Hyoscyamus niger*, *Petunia* and *Lycopersicum esculentum*. In the former case, collapse of lower leaves and fleeting type of vein clearing appears while in the later two plants only mottling results.

Unlike potato virus 'Y' the virus is not transmitted by sap inoculation or grafting to *Solanum nodiflorum* or potato (varieties Craig's Defiance, Arran Victory and Majestic). *D. tatarica* and *Capsicum annuum* are immune.

Dilution end point of the virus lies between 1:1,900 and 1:2,000. The virus retains its infectivity for 24 to 48 hours at room temperature (23° to 27° C). One hour's exposure to 50 per cent. alcohol completely inactivates the virus; its thermal inactivation point is 60° C.

Cross immunity tests with virus 'Y' have shown that virus 'Y' often gives protection against *Jasminoides* virus. This protection is, however, not absolute as sometimes, particularly in tests with young seedlings, the immunity reaction has been observed to break down.

It is of interest to mention that *S. jasminoides*, an ornamental climbing shrub growing all over Simla, is originally a native of South America. Plants of *S. jasminoides* in different localities at Simla and round about were analysed for virus content and all the shrubs, without exception, were found to carry the virus. This would suggest that the virus was probably originally introduced with the plant material from South America. It is significant in this connection to mention that *S. jasminoides* is self-incompatible and stocks growing round about Simla have never been seen to set seed.

Central Potato Res. Inst., PUSHKARNATH,  
Patna,  
April 26, 1952.

### VERNALISATION OF CABBAGE SEEDS (BRASSICA OLERACEA VAR. CAPITATA)

CABBAGE generally does not flower or seed in the plains of Uttar Pradesh. Even if a few varieties may flower, they fail to produce pods and seeds as flowering occurs late in the season when temperature is too high for their development. This handicaps any breeding programme seriously. Besides, cabbage growing in plains is wholly dependent on imported seeds resulting in a financial loss to the country.

Cabbage seed introduction and acclimatisation trials, with 23 varieties from Indian and foreign sources revealed that a number of them could produce seeds in one year by proper manuring and culture, at this Station. But early large drum-head variety, with attractive colour and desirable qualities of head, failed to respond to such treatments. Cabbage is reported to produce seed in one year following vernalization, at times.<sup>2</sup> The seeds of this variety were, therefore, vernalised by the authors to induce earliness in flowering, so that the seed development may be complete before the onset of high temperature period during the months of May and June.

The seeds of early large drum-head variety (Pocha's) of cabbage were vernalised at 32° and 45° F. for four weeks after providing them moisture at 50 per cent. by weight of the seed. The seeds after treatment were sown in pots and 43-days-old seedlings which had develop-

ed 4 leaves each, were transplanted in micro-plots. Sixteen plants were transplanted for observations, under each treatment. The plants received 2 oz. superphosphate per plant per month and were irrigated regularly. The results are given in Table I.

TABLE I

Showing responses of cabbage, early large drum-head variety (Pocha), to vernalisation

Treatment	Day, after transplanting, appearance of				
	Head	Buds	Flowers	Pods	Seed ready
Control	.. 113	..	..	..	213
*32° F.	.. 113	150	169	189	213
45° F.	.. 113	200	..	..	..

\* Nine plants out of sixteen formed pods, and 7 formed seeds.

It would be clear from the Table that plants obtained from untreated seeds as well as those vernalised at 45° F., failed to form seeds, in the latter case buds were observed 200 days after transplanting when they could not form seeds. The flowers formed pods and seeds even when bagged at bud stage, showing no self-sterility in this variety; which is reported to occur in some varieties of cabbage.<sup>1</sup>

Grateful thanks are due to Dr. L. B. Singh for his continued interest in the work and helpful suggestions.

Govt. Fruit Res. Station, N. N. DIKSHIT.  
Saharanpur, U. P. SINGH.  
U.P., India,  
May 27, 1952.

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#### OCCURRENCE OF A NEW RACE (No. 122) OF *PUCCINIA GRAMINIS TRITICI* IN BOMBAY STATE

WHILE examining a few rust samples from Bombay State for the presence of biotypes of race 42 of *Puccinia graminis tritici*,<sup>2</sup> it was observed that one sample from Bagalkot, collected in January 1952, produced type-4 infection on Yalta, a wheat variety which serves as a differential host for race 42B. The reactions of Reliance and Khapli were, however, not

typical of race 42B. Reliance is immune to race 42B, while it is susceptible to the sample from Bagalkot. A new race was suspected and further study has shown that the reactions of the twelve differential wheat varieties are, according to Stakman's key,<sup>1</sup> very much like those of race 122, Reliance being susceptible and Kota immune. None of the present Indian races of stem rust of wheat produces this particular set of reactions.

A few rust resistant varieties of wheat, mainly those used for hybridization by breeders in Bombay and Madhya Pradesh, were tested against this new race and varieties such as Charter, Gabo, Gaza, I.36.32.13.2.1.2 and C.14112 were found resistant to it, as to others. Strain 88, which is almost immune to other races, shows infection types 1 and 2 against the new race and the reaction of E.220 consists of types 2 and 3.

Wheat Rust Station, V. P. GOKHALE.  
Mahabaleshwar, B. P. PATIL.  
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#### AMINO ACID MAKE-UP OF VEGETABLE MILK

THE circular paper chromatographic technique developed in this laboratory was made use of for the separation and identification of the different amino acids present in a sample of vegetable milk processed in this laboratory. Dehydrated and defatted vegetable milk was hydrolysed by autoclaving with 6N hydrochloric acid for 6 to 7 hours. After removing the hydrochloric acid by repeated evaporation, the pH was adjusted to 6.8 to 7.0 by the addition of sodium hydroxide. The solution was then made up to a known volume.

For the identification of the amino acids, the hydrolysate and a known mixture of amino acids were spotted side by side on a Whatman No. 1 (15 cm. diam.) filter paper. The chromatogram was developed as described by Giri, et al.<sup>2</sup> The chromatogram showed that the vegetable milk contains practically all the amino acids.

It was of interest to compare the chromatogram obtained with vegetable milk with that of cow milk. Cow milk was, therefore, treated in the same manner as outlined for the vege-



table milk and the two hydrolysates were spotted side by side on equal nitrogen basis. The chromatogram obtained is given in Fig. 1. A



Circular paper chromatogram showing the amino acid composition of vegetable milk and cow milk.

study of the chromatogram shows that all the bands obtained in the case of cow milk hydrolysate are also present in the vegetable milk hydrolysate. The colour intensities of the different bands are also nearly equal. This observation as also the other experiments (under publication) to determine the nutritive value of the vegetable milk would serve to give convincing evidence concerning the nutritive quality of the vegetable milk.

We wish to express our thanks to Prof. K. V. Giri for his keen interest in the progress of the investigation.

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Indian Inst. of Science, R. RAJAGOPALAN.  
Bangalore-3,  
June 19, 1952.

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### THE OCCURRENCE OF A BLOOD-ANTICOAGULANT FACTOR IN THE LATEX OF *CARICA PAPAYA*

THE action of papain in accelerating the clotting of blood has been studied extensively.<sup>1-4</sup> On the other hand, no work has so far been reported on the occurrence of a factor in papaya latex, which prevents the clotting of blood, except the recently reported finding of Kopaczewski<sup>5</sup> who observed that the latex of *Carica papaya* accelerates the coagulation of blood when used in small concentrations and retards it at higher concentrations.

We have been able to fractionate from the acetone-dried powder of papaya latex two factors, one which accelerates, and another which prevents the clotting of blood. A 2% solution of the acetone-treated latex was prepared in distilled water and centrifuged to remove the suspended matter. The clear supernatant was fractionated with the appropriate addition of solid ammonium sulphate and the precipitates obtained in each case redissolved in distilled water and made up to the original volume. The solutions were dialysed at 0° C. till all traces of ammonium sulphate were completely removed. Three volumes of acetone were added to the dialysate and the precipitate obtained centrifuged off and dried.

The precipitates were dissolved in the same volume of distilled water as the original extract used for fractionation and blood-clotting experiments were carried out using bovine plasma and Russel's viper venom as the source of thromboplastin according to Rahman and Giri.<sup>6</sup> The results of a typical experiment are given below :

Fraction	Clotting time in secs.
0.5 saturation	240
0.75 saturation	18
Full saturation	24
Control	24

It is seen from the above Table that the clotting inhibitor is precipitated at 0.5 saturation of ammonium sulphate and the accelerator at 0.75 saturation.

The clotting inhibitor is also found to prevent completely the clotting of whole blood (human).

The anti-coagulant is heat-labile. In the dry form it can be preserved for some time, but it loses its activity on long standing in aqueous solutions. Work on the purification and chemi-

cal nature of the anti-coagulant is in progress. Details of the work will be published elsewhere.

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August 1, 1952.

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### PRESERVATION OF PAPER CHROMATOGRAMS

THE rapid fading of ninhydrin stained amino acid bands on filter-paper after development of the chromatogram is one of the chief disadvantages for visual comparison and quantitative estimation of the amino acids separated by paper chromatography. For the preservation of chromatograms previous workers have suggested coating the surface of the paper with various materials<sup>1</sup> and treatment with copper nitrate.<sup>2</sup>

We found that coating of the chromatograms with collodion, gelatin, methyl methacrylate polymer, "Perspex" in chloroform and paraffin wax did not prove satisfactory as the colours faded in a short time. Treatment with copper nitrate altered original colours of the bands.

We have found the paper chromatograms retained their original colours when kept in a dry atmosphere. Keeping the chromatograms immediately after developing the colours of the bands with ninhydrin without any previous treatment of the paper in a vacuum desiccator over anhydrous calcium chloride was found to preserve the tone and colour intensity of the bands for more than two months without visible alteration in colour while the chromatograms kept exposed to air faded within a week. Preservation in dry nitrogen atmosphere or at low temperature in closed containers was also found to be effective. The observations point out that the fading is due mainly to atmospheric oxidation in presence of moisture which appears to be very slow at low temperatures. This simple method of preservation of paper chromatograms has obvious advantages over the other methods. In addition to its value for stabilising the original colours its simplicity

should make it specially useful in paper chromatographic analysis.

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July 15, 1952.

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### THE EMBRYOLOGY OF *BORRERIA* *HISPIDA* K. SCHUM. (= *SPERMACOCE* *HISPIDA* LINN.) (RUBIACEAE), A REINVESTIGATION

THE life-history of *Borreria hispida* was studied several years ago by Raghavan and Srinivasan (1941).<sup>1</sup> Since my observations show certain differences, they are summarised below.

Raghavan and Srinivasan state that "The mature seed consists of the remains of the strophiole and the thick integument, the latter of which does not perish as in *Dentella* and *Oldenlandia*. The cells of the integument become thick-walled and the seed thus is very hard ultimately. There is no endosperm surrounding the embryo".

As a result of a thorough developmental study, I find this statement to be incorrect. After fertilisation, the zygote remains quiescent and the primary endosperm nucleus divides rapidly by free-nuclear division. The first division of the zygote takes place when about 200 nuclei have been formed in the endosperm. The endosperm forms a compact mass surrounding the developing embryo. Generally, after the embryo assumes the sphere stage, consisting of about 40 cells, walls are laid down in the endosperm mass enclosing one nucleus in each cell. The embryo remains in direct contact with the surrounding endosperm cells until the differentiation of the organ begins. At the time of initiation of the cotyledons, the part of endosperm in the vicinity of the embryo breaks down and a cavity is formed, in which the embryo lies free, bathed in the nutritive substance produced by the disorganisation of the central mass of the endosperm tissue (Fig. 1).

The outer zone of the endosperm cells, on the other hand, is characterized by having comparatively thicker walls, dense cytoplasm

and prominent nuclei. The endosperm tissue goes on encroaching upon the integumentary cells which become highly vacuolated and their nuclei appear in a degenerating condition (Fig. 3). Ultimately, the whole mass of the

or strophiole. In the beginning the cells of the obturator contain a considerable quantity of starch. The endosperm gradually encroaches upon these cells and consumes the entire central tissue (Fig. 5).

The seed in mature condition consists of the fully developed embryo, the endosperm, the remains of the obturator and the integumental epidermis. The last forms a very hard covering (Fig. 2). The statement that there is no endosperm surrounding the embryo is obviously incorrect.

I am grateful to Prof. P. Maheshwari who suggested this study and helped me in writing the account. I am also indebted to Mr. Reayat Khan and Dr. B. M. Johri for their guidance and advice.

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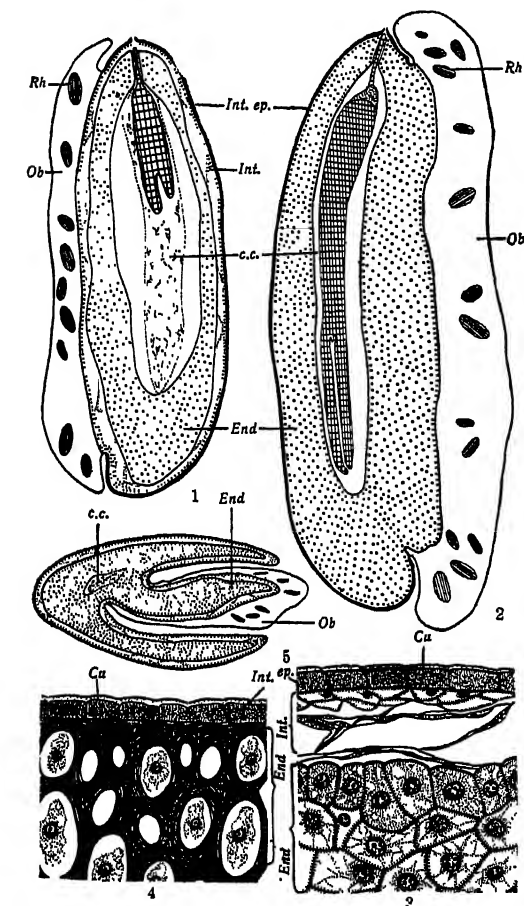
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# OCCURRENCE OF TRANSAMINASE IN THE SILKWORM, *BOMBYX MORI* L.

TRANSAMINASE has been suspected to be functionally associated with protein synthesis. Its possible role in the synthesis of proteins in plants, has been discussed by Virtanen and Laine,<sup>1</sup> Cohen and Albaum,<sup>2</sup> Von Euler,<sup>3</sup> and Braunstein.<sup>4</sup> Its obvious function for which a substantial amount of critical experimental support exists is, however, the interconversion of the essential metabolites associated with intermediary nitrogen metabolism.<sup>5</sup> Shoenheimer and his associates<sup>6</sup> have suggested the reversibility of the reaction involving the transfer of amino groups from peptide chains and amino acids to suitable amino acid acceptors with the formation of  $\alpha$ -keto acyl derivatives of peptides. Such transfers are believed to account in part for the rapid exchange of dietary amino nitrogen of a single amino acid with all amino acids of body proteins. Its participation in the synthesis of amino acids and peptides has been demonstrated by a number of investigators.<sup>7,8,9</sup>

Transaminase activity has been shown to occur in animals,<sup>10</sup> plants<sup>11</sup> and micro-organisms.<sup>12</sup> Conflicting statements have been made with regard to the relationship between transaminase activity and proliferating tissues and secretory glands characterised by rapid protein synthesis.<sup>3,4</sup> Much of the earlier work on this enzyme system has been vitiated by the un-



FIGS. 1-5. *Borreria hispida* K. Schum. FIG. 1. L.s. of young seed (Ob., Obturator; Rh., Raphides; Int. ep., Integumental epidermis; Int., Degenerating integumentary cells; C.C., Central cavity of endosperm; End. Endosperm).  $\times 20$ . FIG. 2. L.s. of mature seed,  $\times 20$ . FIG. 3. Detailed structure of a portion of the seed in Fig. 1 (Cu., Cuticle).  $\times 150$ . FIG. 4. Detailed structure of a portion of the seed in Fig. 2,  $\times 150$ . FIG. 5. T.s. of a seed showing the invagination of endosperm into the obturator,  $\times 2$ .

endosperm consists of highly thickened cells with only a small amount of cytoplasm (Fig. 4). The thick-walled tissue interpreted by Raghavan and Srinivasan (1941) as the integument is, therefore, really a part of the endosperm.

Another interesting point is the invagination of the endosperm into the so-called obturator

satisfactory analytical method employed. The paper chromatographic technique has furnished an elegant method of analytical approach for a study of this enzyme and this has been very successfully employed by Feldman and Gun-salus<sup>1,2</sup> in their study of bacterial transaminases.

We have undertaken a study of the trans-aminase systems associated with the tissues of the silkworm, particularly the hæmolymp and the gland which constitute sites of intense protein metabolism. Papyrographic method of analysis has been employed for the separation and characterisation of the products of the enzymatic reaction.

*Experimental.*—Well-fed, disease-free silkworms in their fifth instar (four days after the fourth moult), were employed for the preparation of the enzyme extracts. The hæmolymp was collected by pricking the larvæ by means of a fine capillary and diluted with twice its volume of M/15 phosphate buffer, pH 7.4. The larvæ were then dissected out to secure (a) the tissues of the intestinal tract, and (b) the silk gland. These were then separately ground up with 10 volumes of M/15 phosphate buffer (pH 7.4) in an all-glass homogenizer with a small quantity of 100 mesh glass powder. All the operations outlined above, were carried out at 5–10° C.; the enzyme extracts were stored in a refrigerator (0° C.) with a layer of toluene. The reagents for the study of transaminase activity consisted of (i) 1.0 M aspartate (Pfansteil) solution in M/15 phosphate buffer pH 7.4, (ii) 0.068 M  $\alpha$ -keto glutarate (B.D.H.), and (iii) 0.1 per cent. solution of calcium pyridoxal phosphate, which served as the co-enzyme. The reaction mixtures were compounded as given in Table I.

by the ninhydrin reagent were similar to those described earlier,<sup>1,3</sup> except for the developing solvent which consisted of Butanol-formic (95%)–H<sub>2</sub>O in the ratio of 10:2:5. This solvent system was found to effect a better separation of aspartic and glutamic acids on the papyrogram. The diagrams of the papyrograms for the various sources of the enzyme (only a few controls are included in the diagram since others gave negative results and, therefore, are not of much significance to be included) are reproduced in Fig. 1, together with the papyrogram obtained with rat heart muscle as the source of the enzyme. Fig. 2 is

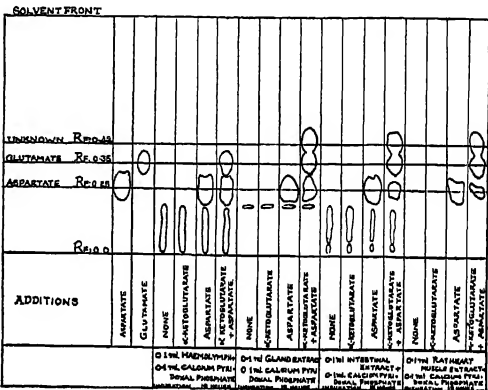


FIG. 1

a diagrammatic reproduction of the papyrogram of the reaction mixtures with intestinal extract and gland extract as the source of the enzyme, spotted at different intervals of time.

*Discussion.*—It will be seen from Fig. 1 that hæmolymp, the glandular and the intestinal extracts of the silkworm contain a trans-

TABLE I

	1	2	3	4	5	6	7	8	9	10
Phosphate buffer M/15 pH 7.4 ml.	..	0.1	0.2	0.3	0.4	0.3	0.2	0.1	0.3	0.2
Pyridoxal phosphate ml.	..	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1
$\alpha$ -ketoglutarate ml.	..	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0
L-aspartate ml.	..	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1
Enzyme extract ml.	..	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
							(boiled)			
Total volume	..	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

The reaction mixtures were incubated at 37° C. At the end of 18 hours, an aliquot of 2.5  $\mu$ l. of each of the reaction mixtures was employed for spotting on Whatman No. 1 filter-paper. The method of development of the papyrogram and the development of the colour

aminase capable of mediating the transfer of the amino group of aspartic acid to  $\alpha$ -keto-glutaric acid. Controls in absence of the combined presence of aspartate and  $\alpha$ -ketoglu-tarate, do not give any glutamic acid spot (Rf value 0.35). While in the case of hæmolymp

a single spot of glutamic acid is obtained as the result of enzyme activity, a second spot in addition to the glutamic acid spot appears in the case of three reactions carried out with glandular and intestinal extracts of the silkworm and with the extract of the heart muscle of the rat. This additional spot which has an Rf value of 0.42 must be taken to represent a peptide which is the product of enzymatic transpeptidation known to be associated with such enzyme systems.<sup>14</sup>

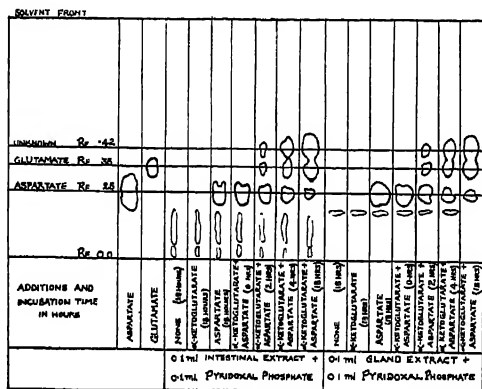


FIG. 2

Fig. 2 gives a diagrammatic reproduction of the papyrograms carried out with reaction mixtures spotted at different intervals of time. It will be seen that in the case of the intestinal and glandular extracts, there is progressive decrease of the aspartate spot which is accompanied by a corresponding increase of the enzymatically formed glutamate. In the course of these studies we have observed that the transaminase activity is higher in the case of the glandular and intestinal extracts while the hæmolymph exhibit a comparatively low activity.

These transaminase studies are being extended to other amino group donors (amino acids) and  $\alpha$ -keto acid acceptors.

Our grateful thanks are due to Professor M. S. Thacker, Director, Indian Institute of Science, for providing us excellent facilities for our work and for his kind interest in these investigations. We are indebted to the Government of Mysore and to the Government of India for financial support. Our thanks are also due to Messrs. D. Shankaranarayana and B. S. Shankarappa for their valuable co-operation in the course of these investigations.

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#### ISOLATION OF A NEW SAPONIN AND SAPOGENIN, ALBIZZIAGENIN, FROM *ALBIZZIA LEBBEK*, BENTH. (N. O. LEGUMINOSAE)

WITH reference to the report by N. D. Ghatge and N. M. Shah<sup>1</sup> that saponin had been detected in the seeds of *Albizia lebbek*, we wish to report that saponin from the pericarp of the beans of *Albizia lebbek*, Benth. has been obtained by us as a creamy powder, m.p. 115°-20° C. It answers to all the tests of saponin: in very high dilutions it shows a high hæmolytic activity on the red blood corpuscles,<sup>2</sup> accelerates germination and growth of wheat seeds (communication in press) and foams copiously in water. The sapogenin obtained from it has m.p. 316° C. and composition  $C_{27}H_{42}O_4$ . Its properties differ very much from all the known sapogenins of this formula.<sup>2,3</sup> Therefore, the authors have named it Albizziagenin. A number of its derivatives have been prepared to support it. The seeds and the bark have also been examined and saponin obtained from them. Fuller details will appear elsewhere.

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# FERRIFEROUS DIOPSIDE (SALITE) FROM GOTIVADA, VIZAGAPATAM DISTRICT

In the manganese pit at Gotivada (Long.  $82^{\circ}44'$ ; Lat.  $17^{\circ}33'$ ), greenish pyroxenes are seen in association with the ore body. The pyroxenes occur as big crystals interpenetrated into one another in the manganese ore. A specimen was found to have the following properties:

**Megascopic characters.**—Colour, green, occurrence, as big blades; fracture, even; hardness, 5 to 6; streak, none; alteration, to serpentine.

**Microscopic characters.**—Idiomorphic; has two sets of cleavages set at  $92^{\circ}$ ; slightly pale green; no pleochroism; biaxial and positive;  $Z$  to  $c44^{\circ}$ ;  $2V$  is positive  $62^{\circ}$ ; twinning observed in a few grains; associated with biotite, manganese ore and brownish pyroxene (an alteration product of green pyroxene).

**Chemical Analysis.**—The following percentage values were obtained by analysis:  $SiO_2$  52.36;  $Al_2O_3$  00.07;  $Fe_2O_3$  1.89;  $FeO$  8.74;  $MnO$  00.23;  $CaO$  24.43;  $MgO$  13.06;  $H_2O$  0.22. These give molecular numbers 0.886 RO, 0.013  $R_2O_3$ ; 0.873  $SiO_2$ . The formula very nearly resolves to RO.  $SiO_2$  type.<sup>1</sup> The smaller amounts of  $Fe_2O_3$  and  $MnO$  are presumed to be present as impurities in the form of magnetite, etc., and deducting these the following percentage values were obtained for the normative minerals Wo 49.4; Fs 37.0; En 13.6.

When plotted on the En-Wo-Fs trilinear diagram,<sup>2,3</sup> these values yield a point falling on the Diopside-Hedenbergite line and in the field marked by Salites, a ferriiferous variety of Diopside. The ratio between Diopside and Hedenbergite is 72.4 : 27.6, or the mineral nearly consists of 75 parts of Diopside with 25 parts of Hedenbergite.

From the graph given by Winchell<sup>4</sup> relating to the chemical composition and optical characters, the  $2V$  value for a mineral of this composition approximates to  $61^{\circ}$  which very closely agrees with the observed value of  $2V$ ,  $62^{\circ}$  (pos).  $Z$  to  $c$  value which is  $44^{\circ}$  corresponds to that calculated from the graph.

It is interesting to note that Fermor<sup>5</sup> describes pyroxene from Tadur, Kodur, Chintala-valasa areas in Vizag District for which the optical data given by him agrees with the values obtained by the present writer on the pyroxenes at Gotivada. Fermor has not given any chemical data. He surmised that they may be manganiferous pyroxenes but this is not supported by the analytical values.

**Genesis.**—The pyroxenes are found in the deposit which is associated with the khondalites. The preponderance of calcium and magnesium shows that the manganese is precipitated as a sediment along with the impure calcareous sediments. The dolomites in course of metamorphism probably interacted with the available silica giving rise to minerals of diopside-hedenbergite group which were later partially altered to brown types of pyroxenes, members of Schefferite series.

I thank Prof. C. Mahadevan for his valuable suggestions and helpful criticism.

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July 2, 1952.

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## 4-HYDROXY 2:5 DIMETHYL QUINOLINE AND 4-HYDROXY 2-METHYL 5-CHLORO QUINOLINE

By the method of Conrad and Limpach,<sup>1</sup> Spivey and Curd<sup>2</sup> cyclised ethyl  $\beta$ -arylamino crotonate of *m*-toluidine to give a mixture of two isomers, viz., 4-hydroxy 2:7 dimethyl quinoline and 4-hydroxy 2:5 dimethyl quinoline. They were separated in the form of their oxalates. In the case of *m*-chloroaniline crotonate, however, the 7-isomer only, viz., 4-hydroxy 2-methyl 7-chloro quinoline could be isolated in the form of its picrate...

By using acetic anhydride-sulphuric acid reagent, a method has been developed in this laboratory to cyclise the crotonates. It has the peculiar advantage of giving in both the above cases 5-isomers only, viz., 4-hydroxy 2:5 dimethyl quinoline (m.p.  $274^{\circ}C.$ , yield = 73%; m.p. reported by Spivey,  $278^{\circ}C.$ ) and 4-hydroxy 2-methyl 5-chloro quinoline (m.p.  $261^{\circ}$ – $62^{\circ}C.$ , yield = 40%). Cyclisation of crotonates could be effected easily at room temperature, without external heating, as heat of reaction alone was sufficient for the purpose. The details will be published elsewhere.

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Surat, July 19, 1952.

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**DETECTION OF MOLYBDENUM—  
IMPORTANCE OF HYDROGEN ION  
CONCENTRATION**

THE reduction of hexavalent molybdenum salts in acid medium to molybdenum blue was observed by Berzelius and the colloidal nature and the composition as  $\text{Mo}_8\text{O}_{23}\cdot x\text{H}_2\text{O}$  were attributed by Schirmer.<sup>1</sup> The KCNS reaction observed by Braun<sup>2,3</sup> is cited as one of the most sensitive methods for the detection of Mo. The constitution of the substance responsible for the red colour is not known with certainty. By studying the co-ordination compounds of pentavalent molybdenum with  $\text{NH}_4\text{CNS}$ , James and Wardlaw concluded<sup>4</sup> that the red colour is due to the formation of  $\text{R}_2[\text{MoO}_2(\text{CNS})_4]$ . The influence of the hydrogen ion concentration on their formation was not studied in the above investigations. Recent work<sup>5,6</sup> on molybdenum-thiocyanate complex also does not deal with this aspect.

In the experiments now performed, a 10% aqueous solution of ammonium-molybdate, saturated solution of  $\text{H}_2\text{S}$  (as a reducing agent), near about 2N solution of pure KCNS were used. The reactions were studied between pH 1 and 6 using sodium acetate-hydrochloric acid buffer solutions and also with 1-12N hydro-

chloric acid. Other things remaining constant, brown colour appeared between pH 3 and 6; green and blue at pH 2 and 1 respectively. The blue colour was unstable at higher acid concentrations. The red colour in the sulphocyanide reaction is obtained only at and above 2N, and below this normality the unchanged Mo-blue is noticed. The colour changes are pH-reversible. This has been well verified by developing the red colour first and then reducing the acidity by various methods.

It is thus evident that hydrogen ion concentration exerts a marked influence on the above two principal qualitative tests for Mo and the pH has to be carefully controlled for the successful detection of Mo. Work is in progress to explain this behaviour in the light of the isopolyacid formation indicated by Jander and others.

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June 17, 1952.

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**NEED FOR GEOPHYSICAL RESEARCH IN INDIA**

ANY number of instances may be given to prove that rich natural resources are not in themselves a guarantee for a nation's prosperity. California a century ago was a decadent Spanish colony of extremely poor and superstitious famine-stricken farmers. Under American flag, its rich resources in gold, oil and water have been harnessed to make it the most prosperous State of the American Union. Kuwait was an arid desert a decade ago; but with the discovery there of the richest oilfield in the world, large cities have sprung up overnight as it were with all modern amenities including a water supply system based on the distillation of 2 million gallons of sea-water per day. Modern Geophysics gives to the initiated a vision of underground structures even to depths of 5,000 ft. It has given a clue to the discovery of oil, lignite, gold, nickel, chromite ores in the snow-capped regions of the Arctic, placer gold and borax in the western deserts of the United States, underground water in the table land of South Africa. The Standard Oil

Company is now carrying out a geophysical survey of the rocks underlying the Bengal alluvium by airborne magnetometer; and the results appear promising enough for this company to start delicate negotiations with the Government of India regarding terms and conditions for exploration of oil in that region.

It is time that a Geophysical Research Institute on an adequate scale is established in India to follow up this adventure of the American Oil Company. The greatest resource of a nation is its storehouse of scientific knowledge and technical skill, because without it, the storehouse of raw materials which might be in the country as a gift from Nature remains buried or unused and is not harnessed for better living. A Geophysical Research Institute may well be the principal key for unlocking and developing for human betterment, the buried resources of India.

\* Summary of an address by Dr. J. C. Ghosh, to the Annual Meeting of the Geological, Mining and Metallurgical Society of India on the 3rd September, 1952.

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## REVIEWS

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trasonic Physics. By E. G. Richardson. (Elsevier Publishing Coy., London), 1952. Pp. x + 285.

Ultrasonics, in recent years, has placed in the hands of the experimental physicist a powerful tool for investigating the properties of solids and fluids. Some of them may very well come under the purview of molecular physics. The advent of many new instruments and methods of a precise measurement of the propagation constants has been responsible, to a large extent, for the progress made in the experimental work in fluids. Several books have been published on ultrasonics where the stress is laid more on the technical applications but there are not many in the field which lay stress on the physical aspects.

This need has been met with by the present book under review. The author himself has been a researcher in this field for the past two decades and has given a coherent account of the various methods of investigation employed by him and his school as well as by other workers. A considerable number of pages has been devoted to a description of the construction and use of ultrasonic interferometers as precision instruments. The results obtained by the different investigators are presented extensively and are invariably followed by a critical discussion from the theoretical standpoint. There are eight chapters. It appears to the reviewer that the book will be of great help to people who wish to start original work in this field as several experimental details are given by an author who has known them well and himself developed some of them. The references given at the end of each chapter are very exhaustive. S. B.

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Directory of Indian Mines and Metals. Compiled by P. K. Ghosh. (Published by the Mining, Geological and Metallurgical Institute of India), 1952. Pp. 208. Price Rs. 15.

The Mining, Geological and Metallurgical Institute has done a great service in sponsoring the publication of this valuable Directory and it is specially so because of the absence of any authoritative reference work of this description in the country. Mr. Ghosh, the compiler, has done a splendid job and has gone to the most authoritative sources of available in-

formation in providing statistics of production, price levels, ownership of mines, acceptable specifications of mine products, etc. A special feature of the publication is that it not only provides statistical data, but gives good information on the uses of the industrial products, and the commonly used mining equipment and ore-treatment plants. The mining and mineral industries will find the volume useful in their development plans.

The provision of a Mineral Map of India, based on the publications of the Geological Survey of India, adds to the value of the book. B. P.

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Tungsten—A Treatise on Its Metallurgy, Properties and Applications. By Colin J. Smithells. (Published by Chapman & Hall), 1952. Pp. 326. Price 75 sh.

The last edition of the book appeared fifteen years ago and since then many developments have taken place in the technology of this strategic metal and its industrial applications. The author and the publisher have rendered a valuable service in bringing out the third edition. In this work, many noted experts have collaborated with Dr. Smithells who assumes the role of an editor, and the result is an authoritative presentation of the available information.

The book has thirteen chapters. The introductory chapter gives the history, geology and mining of tungsten ores and minerals together with statistical data. The next three chapters deal with the extractive metallurgy of tungsten. Chapter 5 is devoted to the production of ductile tungsten and provides details of the powder metallurgy techniques adopted for its manufacture. Information is available on wire-drawing, wire testing and joining tungsten by welding and brazing. Chapter 6 is concerned with the metallography of tungsten including electron microscopy. The production of single crystal wires is discussed. The next three chapters relate to the study of the effect of cold work and annealing on physical properties of the metal, the dependence of physical and mechanical properties on temperature, and the thermionic characteristics of tungsten. The effects of pressure, temperature, particle size and other variables on recrystallisation and



grain growth are well reviewed. The next three chapters cover the alloy systems, manufacturing methods and industrial applications of tungsten, tungsten-iron, non-ferrous alloys and tungsten carbides. The last chapter summarises the methods of assay of the metal and gives the accepted specifications.

The book is amply illustrated with photographs, tables and graphs, and will be found valuable by the specialist and the student alike.

B. P.

**Pulp and Paper—Chemistry and Chemical Technology.** By James P. Casey. (Inter-Science Publishers, Inc. New York), 1952. Vol. I. *Pulping and Paper-making*. Cloth bound, 6 × 9. Pp. xxiii + 795. Price \$15. Vol. II. *Properties of Paper and Converting*. Cloth bound, 6 × 9. Pp. xvii + 609. Price \$15.

This comprehensive and excellent book is written in two volumes. Volume I is devoted to pulping and paper-making and Volume II deals with properties of paper and converting. For the successful manufacture of any product with required properties it is essential to have a thorough knowledge of the chemical and physical properties of all the substances used and of the fundamental principles underlying the various processes employed in its manufacture. This book serves these purposes very admirably so far as the subjects of pulping, paper-making and converting are concerned. The claim of the author that the book "approaches the study of the paper-making raw materials and processes from the standpoint of the colloid and physical chemist" is fully justified. The material has been presented in fundamental terms but care has been taken to see that the gap between strict theory on the one hand and extreme empiricism on the other is properly bridged.

Volume I is divided into fifteen sections. Commencing with a detailed examination of cellulose and hemicellulose, lignin and pulpwood, a very comprehensive treatment is presented of pulping—sulphite, alkaline, mechanical, chemigroundwood, semi-chemical and miscellaneous processes. Subsequent sections deal with the subjects of bleaching, fibre preparation, nature of fibre bonding, sheet formation, filling and loading, and internal and surface sizing. The final sections are devoted to wet strength, colouring, microbiology, and the properties and treatment of water.

Volume II has eight sections and deals with properties of paper, physical, optical, chemical

and electrical, uses of statistics in the paper industry, pigment coating, printing, laminating and pasting, internal treatment and coating of paper with resinous materials, and resins, natural and synthetic.

Each volume has excellent author and subject indices. The copious and up-to-date references to original sources considerably enhance the value of the book. The numbering of sections and pages in Volume II is a continuation of that in Volume I.

Much progress in pulping, paper-making and converting has taken place in recent years and the author has spared no pains to describe fully even the latest developments in this field. The book is not a mere collection of facts and figures but presents a balanced and critical account of all the aspects of the subject. The treatment is lucid and impressive. Both the volumes are eminently readable and are useful not only to students and mill chemists and technologists but also to research workers.

On page 246, Volume I, bamboo is referred to in Latin as *Dendrocalamus arundinacea*. Evidently, *Bambuseae* is meant. In any case, there is no bamboo known as *Dendrocalamus arundinacea*. Apart from this the book is singularly free from lapses.

R. V. BHAT.

**Mechanical Properties of Metals at Low Temperatures.** (National Bureau of Standards Circular 520), 1952. Pp. 206. Price \$1.50.

The book represents a collection of 9 different papers dealing with almost all European and American investigations, with the relations between alloying elements, structure and grain size on one side and the transition temperature on the other. Special attention has been given to certain steels, non-ferrous and light metals important as structural materials at low and very low temperatures as Cr-Cu-Ni- and austenitic stainless steels. But it is well emphasised that not only the initial metallographic state of a steel determines its behaviour at low temperature but also its more or less resistance to become martensitic on cold-working.

A special chapter is devoted to the tensile properties of copper, nickel and some of their alloys, while two other papers deal with the application of metals in aircrafts and ships at lower temperatures and their tendency to brittleness after welding.

A very important chapter describes the effects of dimensional changes of test specimens of fracture. But in this respect it is regrettable

that the Schnadt notched-bar impact test has not been referred to.

The book represents the first almost complete description of our knowledge about the mechanical properties of metals at low temperatures. The different papers will not only initiate the metallurgist into further investigations, but they will also be highly useful to engineers. Good illustrations and graphs add to the value of the book. Therefore, it can be highly recommended to all those who work in the field of development of metals and alloys, of design, manufacture and application of apparatus, machines and engines for low temperature service.

HANS MAEDER.

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*Inventories of Apparatus and Materials for Teaching Science, Vol. II, Universities, Volume III. Technical Colleges.* (Published by UNESCO, Paris,) 1951.

These publications form part of the new series of inventories of apparatus and materials for teaching science brought out by the UNESCO. The series is designed particularly to aid educationalists in war-damaged and under-developed regions. The publications are reference manuals from which essential equipment necessary to teach science at all levels may be selected. The lists are based upon the material in common use in the more highly developed and industrialized countries.

Details are given of a model curriculum to which the equipment is related. Teachers are, therefore, given guidance about the kind of course they could undertake, and also what equipment is needed for demonstration and experimental purposes. Professors in our Universities would find extremely useful data in these volumes which could be used for re-organizing the various courses of study.

The 'Inventories' are published in three volumes. Volume II deals with science teaching in Universities. Volume III which has just appeared, is concerned with technical colleges and this third part is devoted to agricultural sciences.

A brief account of the organization of a certain number of schools for the teaching of agricultural sciences chosen from different countries is followed by lists of apparatus, instruments and other equipment necessary for such schools. To illustrate the lists, a syllabus of courses for which such equipment is necessary is given as an example for each of them.

*Colour in Theory and Practice.* Edited by H. D. Murray. (Chapman & Hall, London), 1952. Pp. 360. Price 70 sh. net.

The second edition of this book, rewritten by a panel of eight experts, makes simple and pleasant reading. The first eight chapters are concerned with many essential and some non-essential topics on light and its interaction with matter. The next seven chapters describe visual physiology, elucidate the three attributes of colour sensation and develop three-colour algebra in an informal manner. The C.I.E., Vector, Munsell and Ostwald systems receive due consideration. The chapter on colour discrimination is a useful one, comparing as it does the several proposed U.C.S. transformations and their efficacy. There is a scholarly, but of necessity inconclusive "explanation" of colour vision and a short but adequate chapter on colour-blindness. In the next five chapters on light sources and colorimetry, the account of light sources is probably too detailed. On the other hand, spectrophotometric theory is briefly dismissed. There is an account of many spectrophotometers, but this does not include the universally popular Beckman instrument. Visual colorimeters are treated with justice and there is a good general discussion on photo-electric instruments. The last section of the book, on miscellaneous topics, makes very interesting reading. But it could have been enriched by a discussion of some more topics of importance, for instance, gloss, lustre, and the theory of colorant layers. The absence of a historical account of colour physics is to be deplored. It is also felt that a short chapter on photometry would have been useful. The appendices contain much useful material and the bibliographies are more than adequate. The get-up and illustrations are excellent. Despite the steep price, the book may be warmly recommended to those who are interested in the scope and uses of the subject rather than its mathematical formalism.

T. RADHAKRISHNAN.

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*Mitchourine, Lyssenko et le probleme de l'hérédité.* par. Jacob Segal. Les Editeurs Français Réunis, 33, Rue Saint-Andre-des Arts Paris (6').

Like Luther Burbank, Michurin appears to have been a horticultural wizard. But unlike Burbank, Michurin's methods of approach have received the official blessing of those in power in the U.S.S.R. A new science, the so-called "Michurinism", has been brought into being.

A scientist, it is often stated, is rarely honoured in his own country. But Michurin won this distinction. The U.S.S.R. appears to have gone further having compelled acceptance of "Michurinism" by official insistence at the dictation of the party hierarchy. It is this which has been criticized by leading biologists in the democracies.

The book under review is admittedly a defence of Michurinism (p. 8) and as such has all the usual failings. The much publicized conference on "The Situation in the Biological Sciences" held in 1948 is claimed as a revelation which ended in the brilliant victory of Michurinian science (p. 8). This appears to be only one side of the picture. Muller (*Bull. Atom. Sci.*, 1948) offers the following comment: "Finally Lysenko made his historic announcement that the Communist Central Committee had in fact prejudged the case, and had already decided in his own favour. This decision by a non-scientific body, of course, decided the issue". Controversies are not unknown in science. But the so-called victory of Michurinian science led to the discharge with disgrace of the leading students of heredity and evolution of Mendelian inspiration. These facts, of course, find no place in the book under review.

One is surprised to read of Michurin's belief that science could be constructed on the basis of the theories of Marx, Engels, Lenin and Stalin and that the philosophy of dialectic materialism is an instrument for the transformation of the objective world (p. 13). No wonder this method of approach has not appealed to scientists outside the U.S.S.R. who have ignored the papers of the Soviet school (p. 11).

The book is interesting to read and would give the orthodox geneticists an idea of the objections of the supporters of Michurinism.

M. K. S.

**Protomorphology—The Principles of Cell Auto-Regulation.** By Royal Lee and W. A. Hanson. (Lee Foundation for Nutritional Research, Milwaukee, Wisconsin), 1947. Price \$8.50.

The Lee Foundation have been waging a war against ignorance in nutritional matters and have never missed a chance of criticising the distributors of substitutes for minor but essential components, such as vitamins. They have extended their activity to include every phase of life, covering factors that maintain normal health and also those that produce disease. In doing so they have been inspired by

the work of the late Prof. T. B. Robertson. His theory of allelocatalyst assumes that "the reproducing cells secrete a substance into the media which exerts a powerful influence on cells inhabiting the tissue and the body as a whole." Facts seen from this point of view are presented in the book under review and they are most conspicuous in the appendix on cytotoxins by Prof. Victrow of Russia who attributes tissue specificity to them. Exploiting such specificity cyto-toxins can be used to attack such wide problems as increasing the egg-laying capacity of hens and reducing sugar in diabetes. The book is well printed, well written and shows that the authors had the courage of their conviction. Where facts are presented in the classical manner the reader will learn much and where they are offered from the new standpoint they would set him thinking. It is here that the book seems quite unique.

S. M.

**Electricity Meters and Instrument Transformers.** By S. James. (Chapman & Hall, London), First Published 1952. Pp. 467. Price 50 sh.

There are a number of books on electricity meters and instrument transformers written by engineers in the electricity supply industry and teachers in engineering. The book under review is by an engineer who has been closely associated with the manufacture of electricity meters and instrument transformers. The author has also been associated in the task of drafting and standardising the British Standard Specification for electricity meters and instruments transformers. The book thus fills a need in giving a complete picture as to the construction and performance and practical working of these instruments both from the users' and manufacturers' points of view. Many matters dealt with in great detail will be of assistance to the student and the young engineer.

In the first chapter the author deals with the specifications and legal requirements relating to electricity meters. A chapter is devoted to different types of D.C. meters. Single-phase meters and the influence of transformer errors are dealt with in detail in two chapters. Two-phase metering, though not in common practice, has also been included along with poly-phase metering.

Commencing with the historical pre-payment meters a large number of types of pre-payment meters has been described in two chapters. These include the single-rate, step-rate and two-part tariff pre-payment meters.

In the fixation of tariffs as applied to large power consumers, a detailed knowledge and understanding of the theory and operation of reactive meters, kVA meters and maximum demand meters, are essential. One chapter each has been devoted to these instruments. For reactive meters the problem of idle currents and of interconnectors have been dealt with. In dealing with kVA meters, meters for ranges of power factor from 0.0 to 1.0 as also meters with spherical integrators have been discussed. Ambiguities in the measurement of kVA have also been treated.

With the advent of the grid system of operation of interconnected power stations, the measurement of bulk supplies to large power consumers has become an important aspect of power metering, and summation meters are being increasingly used for the purpose. A whole chapter has been devoted to the discussion of different types of summation meters.

Current and voltage transformers are essential in the metering of large power consumers and bulk supplies. An understanding of the characteristics and use of these is essential in metering practice. A chapter each has been devoted to the consideration of these.

An useful appendix gives a summary of the revision proposed to the British Standards Specification for electricity meters and instrument transformers.

All the instruments discussed are of British manufacture. It would have been more informative if more information were included of the practice in the manufacture of these in the continent and in the United States of America. A bibliography of references to trade or other literature would have been helpful to students and other workers in the field.

The book serves a very useful purpose of getting the view-point of engineers on the manufacturing side of meters and instrument transformers. The publication of a companion volume devoted entirely to the testing of electricity meters and instrument transformers will be welcome.

C. S. G.

#### Books Received

*Corrosion Testing Procedures.* By F. A. Champion. (Chapman & Hall), 1952. Pp. xi + 369. Price Rs. 36.

*Advances in Catalysis*, Vol. III. Edited by W. G. Frankenburg, I. Komarewsky and E. K. Rideal. (Academy Press Inc.), 1952. Pp. xi + 360. Price \$ 7.80.

*Selected Topics from Organic Chemistry.* By D. D. Karve and G. D. Advani. (Dastane Bros., Poona 2), 1951. Pp. vi + 507. Price Rs. 12.

*The Sources and Nature of the Statistics of the United Kingdom*, Vol. I. (Macmillan & Co.), 1952. Pp. viii + 352. Price 21 sh.

*Vermiculite* (Colonial Geological Surveys Mineral Resources). By E. R. Varley. (H. M. Stationery Office, London), 1952. Pp. iv + 70. Price 7 sh. 6 d.

*International Review of Cytology*, Vol. I. Edited by G. H. Bourne and J. F. Danielli. (Academic Press Inc., New York), 1952. Pp. 368. Price \$ 7.80.

*Molybdenum Compounds, Their Chemistry and Technology.* By D. H. Killeffer and Arthur Linz. (Interscience Publishers), 1952. Pp. xiv + 407. Price \$ 10.50.

*Maize in the Great Herbals.* By John J. Finan. (Chronica Botanica), 1950. Pp. xiv + 149-191. Price \$ 3.00.

*Should Fatherhood Begin at Forty?* By E. Orson Brower. (426, East Girard Avenue, Philadelphia), 1952. Pp. xvi + 240. Price not known.

*The Auger Effect.* By E. H. S. Burlop. (Cambridge University Press), 1952. Pp. xiv + 188. Price 27 sh. 6 d.

*Kwashiorkor in Africa.* By J. F. Brock & M. Autret. (World Health Organisation, Geneva), 1952. Pp. 78. Price \$ 1.0.

*Agriculture and Animal Husbandry Research*, 1929-46, Part II. (I.C.A.R., New Delhi), 1952. Pp. 190. Price As. 8.

*Madhmika Rasayana Sastra (Hindi).* By M. B. Pandey. (Gandhi Bagh, Nagpur), 1952. Pp. 329. Price Rs. 3-4-0.

*Madhmika Bhautika Sastra*, Part I. By M. B. Pandey. (Gandhi Bagh, Nagpur), 1952. Pp. 96. Price Re. 1.

*Corrosion Resistance of Tin and Tin Alloys.* By S. C. Britton. (Tin Research Institute), 1952. Pp. 77. Price 3 sh. 6 d.

*Man in Evolution.* By M. R. Sahni. (Orient Longmanns, Madras 2), 1952. Pp. x + 272. Price Rs. 8-12-0.

*The Physical Principles of Thermodynamics.* By R. A. Smith. (Chapman & Hall), 1952. Pp. xiii + 280. Price 30 sh.

*Colour in Theory and Practice.* Edited by H. D. Murray. (Chapman & Hall), 1952. Pp. xiii + 360. Price 70 sh.

*Polarography*, Vol. I, 2nd Edition. By I. M. Kolthoff and James J. Lingane. (Interscience Publishers), 1952. Pp. xvii + 420. Price \$ 9.00.

## SCIENCE NOTES AND NEWS

### New Biological Standards

An important feature of the Fifth Report of the WHO Expert Committee on Biological Standardisation is the complete and up-to-date list of all current international standards in the form of an Appendix. The publication is priced at 15 cents a copy and is also available in a French edition.

### Dr. S. Krishna

Dr. S. Krishna, till recently Scientific Adviser to the High Commissioner for India and Scientific Liaison Officer in U.K., has been appointed Deputy Director, Council of Scientific and Industrial Research, New Delhi.

### Geological, Mining and Metallurgical Society of India

**Council for 1952-53.**—President: Mr. M. K. Nay. **Vice-Presidents:** Dr. G. P. Contractor, Mr. A. B. Guha. **Joint Secretaries:** Prof. N. N. Chatterjee, Prof. N. L. Sharma.

### Loyal Institute of Chemistry: Bangalore Section

At the Third Annual Meeting of the Bangalore Section, the following officers were elected for 1952-53:

**Chairman:** Prof. K. V. Giri. **Vice-Chairmen:** Prof. K. R. Krishnaswami and Dr. C. V. Natarajan. **Hon. Treasurer:** Mr. I. S. Patel. **Hon. Secretary:** Dr. T. L. Rama Char.

### Ujjain Academy of Sciences

**Office-bearers for 1952-53.**—**President:** Dr. G. S. Mahajani. **Vice-Presidents:** Dr. N. N. Godbole, Dr. A. Mookherji, Shri. M. L. Schroff, Dr. M. L. Roonwal. **Secretary:** Prof. K. Ramamurti. **Treasurer:** Prof. Roshan Singh.

### Electron Microscope in Metallurgy

A Philips 100 KV Electron Microscope has been installed at the Indian Institute of Science,

Bangalore. The equipment will be used for metallurgical research and to teach students the latest control methods in metallurgy. Sri. D. L. Bhattacharya is in charge of the Electron Microscope.

### Formation of Indian Society of Agronomy

Scientific workers interested in the formation of an Indian Society of Agronomy are requested to contact Prof. R. K. Misra, Principal, M.B. College of Agriculture, Gwalior, who is sponsoring it. The move has our heartiest good wishes.

### Award of Research Degree

The University of Poona has conferred the Degree of Doctor of Philosophy in Biochemistry on Mr. T. J. Boman for his thesis on "The Vitamin Requirements and Identification of Lactic Acid Bacteria from Indian Curds and the Study of Their Uses for Microbiological Assays".

The University of Poona has awarded the Degree of Doctor of Philosophy in Plant Pathology to Sri. Y. S. Kulkarni for his thesis on "Some Reports on Bacterial Diseases of Plants."

### Glass Laminate Planes to Fly at 2,000 m.p.h.

According to Mr. Thomas E. Piper, Director of Materials and Process Engineering at Northrop Aircraft Inc., a glass plastic laminate, which would be made by embedding glass fibres in a plastic resin and then moulding it into shape, would withstand the searing 'skin' friction temperatures resulting from ultra high speed flight. He said planes could have glass fuselages, wings, ailerons, and stabilisers, which would be fixed by glass rivets to titanium and stainless steel light weight structural members. These should help to solve the problem of the 'heat barrier' that now prevents a speed of more than twice that of sound.

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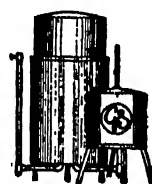
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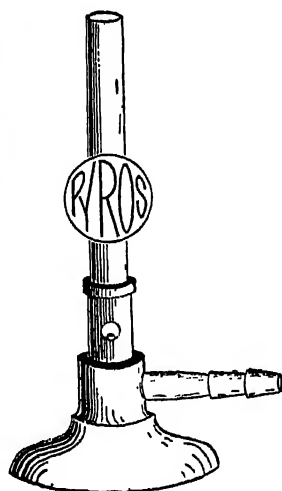
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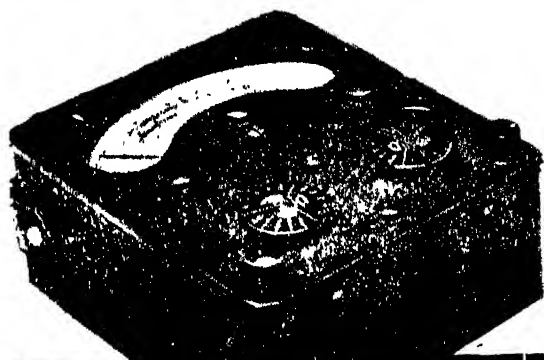
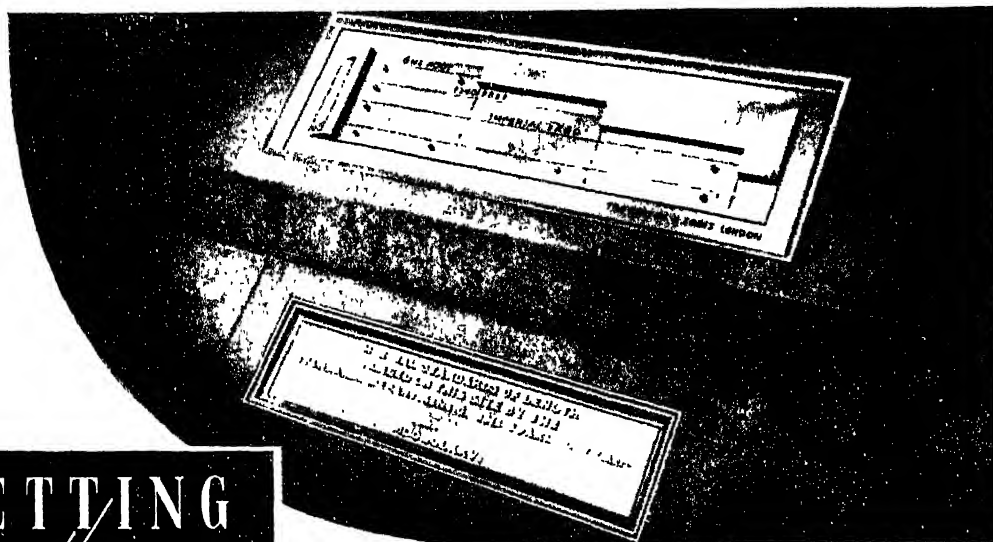
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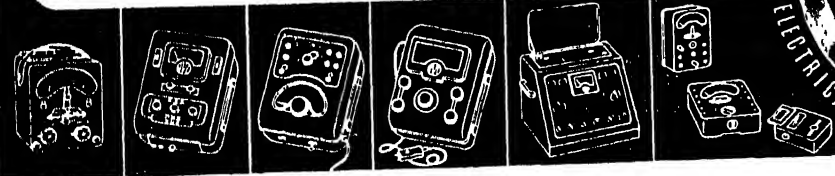


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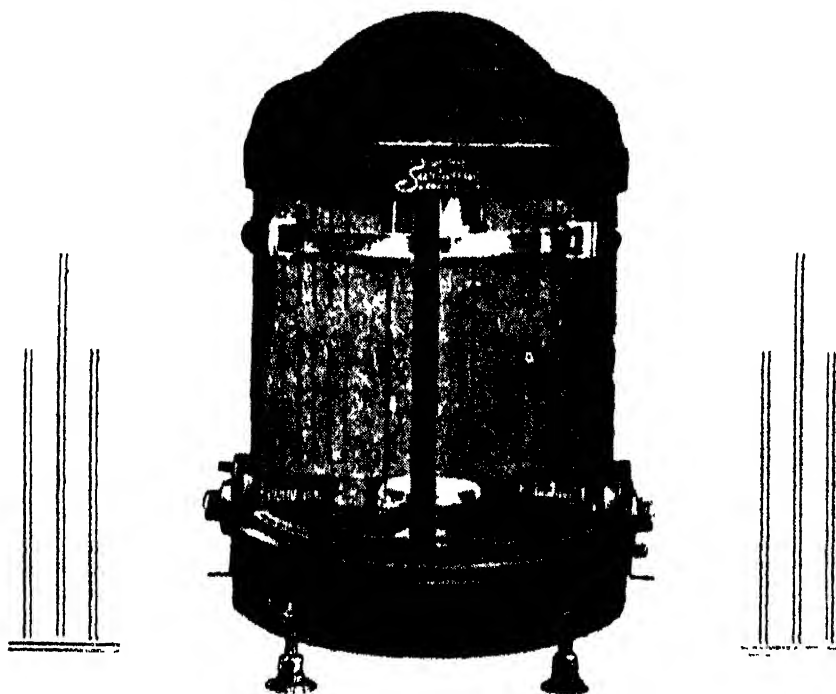
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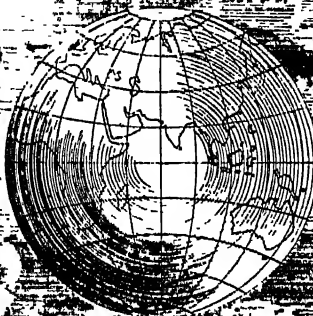
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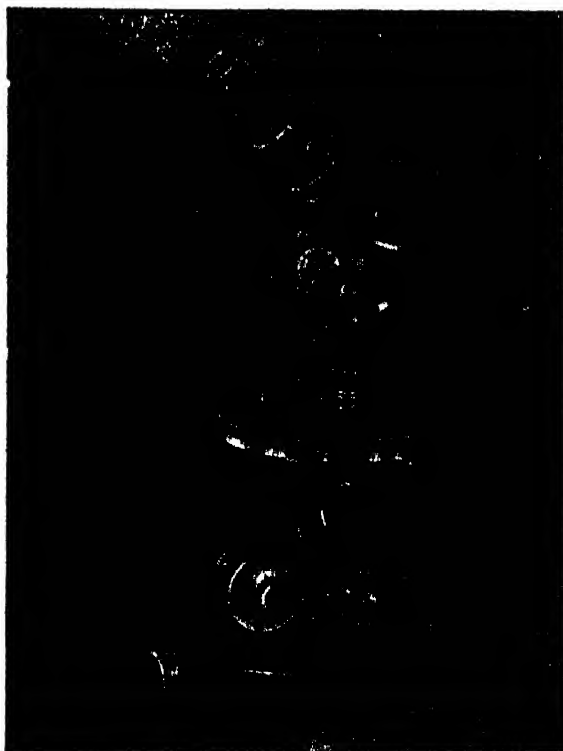
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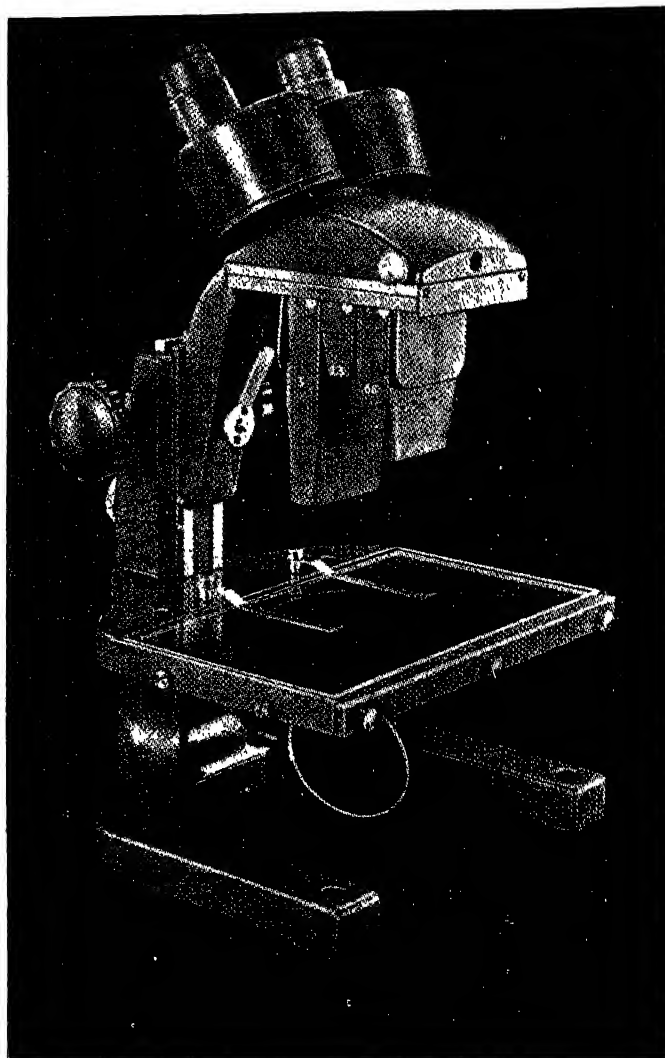
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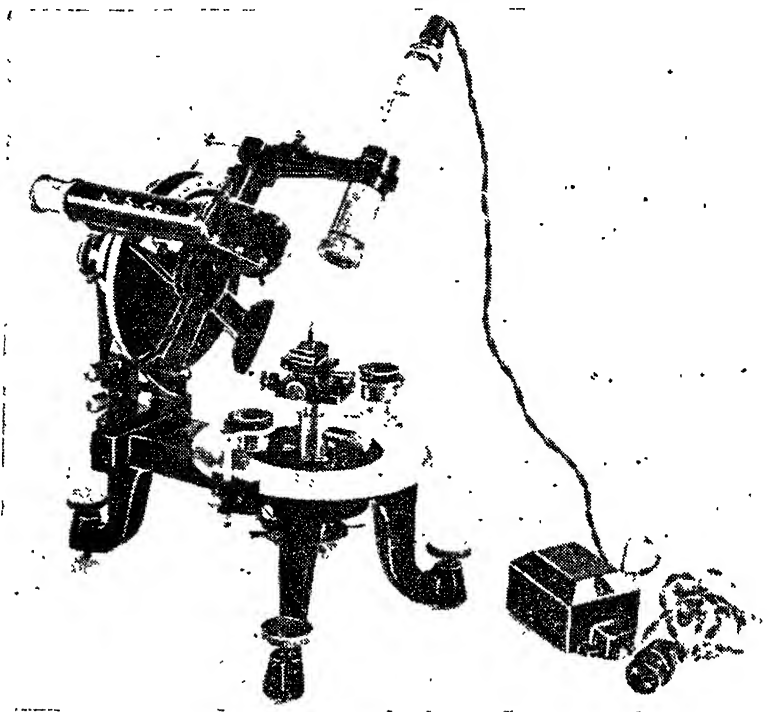
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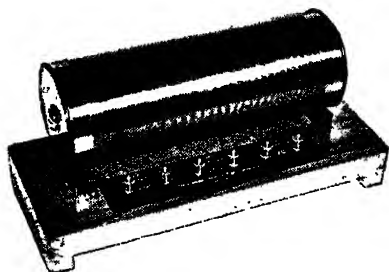
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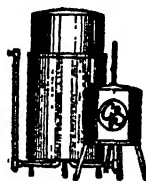


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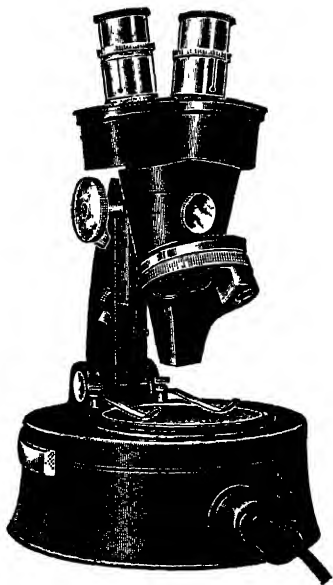
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## SCIENCE AND CITIZENSHIP\*

THE fundamental principle of scientific work is unbending integrity of thought, following the evidence of fact, wherever it may lead, within the limits of experimental error and honest mistake. On this there can be no compromise; and since science is a universal interest of mankind, recognizing no barriers of race, class, religion or opinion (provided that is honest), a necessary condition of its advance and application is one of friendliness, frankness and equality. Goodwill and integrity, therefore, are indispensable alike to scientific progress itself and its successful employment for the benefit of mankind.

In this connection, the common phrase, "this scientific age" is all too apt to imply, with little justification, that the majority of people, at least in highly developed countries, now think and act scientifically; and, with no justification at all, to suggest that science can replace the older motives of human conduct. It is true that the external circumstances of life have been vastly altered by the applications of scientific discovery and invention, though as yet for only a minority of mankind. The future alone can decide whether natural resources and human ingenuity will prove sufficient, given statesmanship and goodwill, for the same transformation gradually to affect the whole of human society.

The development which has brought most vividly to the public conscience to-day the ethical problems aroused by the advance of scientific knowledge lies in the field of nuclear physics; and groups of scientific people in the free countries of the world are vigorously debating its various consequences, among them particularly the secrecy attached to weapons as devastating as those provided by nuclear fission. Atomic physics, however, is only one of many scientific developments which have brought, or are bringing, a mixture of possible good and evil about which judgments of relative value must be formed; we must not get too excited about one of them. There is no secrecy about most of these developments—they occur gradually and continuously before our eyes, and we tend to accept them without question as though they were natural phenomena; yet, in fact, the consequences of one of them provide the most solemn problem in the world. The dilemma is this. All the impulses of decent humanity, all the dictates of religion and all the traditions of medicine insist that suffering should be relieved, curable disease cured, preventable disease prevented. The obligation is regarded as unconditional: it is not permitted to argue that the suffering is due to folly, that the children are not wanted, that the patient's family would be happier if he died. All that may be so; but to accept it as a guide to action would lead to a degradation of standards of humanity by which civilization would be permanently and

\* Abstract of the Presidential Address of Prof. A. V. Hill, F.R.S., to the British Association, 1952.

indefinitely poorer. Conduct usually falls short of principle; but that would be the worst reason for abandoning principles altogether.

In many parts of the world, advances of public health, improved sanitation, the avoidance of epidemics, the fighting of insect-borne disease, the lowering of infantile death rates and a prolongation of the span of life have led to a vast increase of population. Not only is the population increasing, but also in many places its rate of increase is still rising; and these processes will take so long to reverse that for many years to come the shortage of natural resources, particularly of food, is bound to provide increasing deprivation and disturbance.

Referring to India, nobody would dare to say that steps to combat diseases, such as tuberculosis and cholera, to improve rural and industrial health, to increase the supply of drugs and medical equipment and services, should not be taken on the highest priority; but the consequence must be faced that a further increase of a million people a year would result. Thus, science, biological, medical, chemical and engineering, applied for motives of decent humanity entirely beyond reproach, with no objectionable secrecy, has led to a problem of the utmost public gravity which will require all the resources of science, humanity and statesmanship for its solution.

The example of India has been taken because of the sheer magnitude of the problem and because its seriousness is now admitted by humane and responsible men; but the same conditions exist already in many parts of the world and will soon exist elsewhere. It is not a question only of food; if a higher standard of life is to

become universal, with education, communications, housing, reasonable amenities and public health, a far greater demand will be made on all such natural resources as power, chemicals, minerals, metals, water and wood. One is left wondering how long these can possibly take the strain. Could world supplies conceivably hold out if the present requirement per head in the United States were multiplied in proportion to meet the same demand everywhere—even without any increase of present population; and if so, for how long? There is much discussion of human rights. At what level can these be reasonably pitched? And do they extend to unlimited reproduction, with a consequent obligation falling on those more careful? These problems must be faced not only with goodwill and humanity but also with integrity and courage, not refusing to recognize the compulsion of simple arithmetic.

Co-operation is required, not conflict; for science can be used to express and apply the principles of ethics, and those principles themselves can guide the behaviour of scientific men; while the appreciation of what is good and beautiful can provide to both a vision of encouragement.

It is true that scientific research has opened up the possibility of unprecedented good, or unlimited harm, for mankind; but the use that is made of it depends in the end on the moral judgments of the whole community of men. It is totally impossible now to reverse the process of discovery; it will certainly go on. To help to guide its use aright is not a scientific dilemma, but the honourable and compelling duty of a good citizen.

---

## SECOND INTERNATIONAL CONGRESS ON RHEOLOGY

THE British Society of Rheology, supported by the Joint Commission on Rheology of the International Council of Scientific Unions, is arranging to hold the Second International Congress on Rheology at St. Hilda's College, Oxford, England, from July 26 to July 31, 1953.

The Congress will cover the whole field of the study of the deformation and flow of matter, except such specialized subjects as have come to be regarded as branches of applied mechanics, *e.g.*, the classical theory of elasticity, aerodynamics.

Papers which must not exceed 2,000 words in length (including space for figures) will be

accepted subject to referees' approval and should reach the Organizing Secretary, Dr. G. W. Scott Blair, The University, Reading, England, by December 1, 1952. The Proceedings will be published in book form, and, since it is intended to circulate proofs of the papers at the Congress itself contributions cannot be guaranteed inclusion in the Proceedings, if received late.

Arrangements will be made for excursions, visits to Colleges, etc., during the Congress. The wives of rheologists are welcome. The fee for the Congress, including available pre-prints, and a copy of the final Proceedings, is expected to be about £ 4, payable before May 1, 1953.

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## NUFFIELD FOUNDATION TRAVELLING FELLOWSHIP AWARDS FOR 1953-54

THE Nuffield Foundation, with the object of advancing the interests of India as a whole and further strengthening the academic ties between India and the United Kingdom, has decided to make available to India five Travelling Fellowships for the year 1953-54. An Advisory Committee in India has been appointed by the Foundation to advise them on the administration of the scheme, consisting of Shri V. T. Krishnamachari, Member, Planning Commission (Chairman), Shri S. Varadachariar, Dr. C. V. Raman and Shri J. J. Ghandy. It has been decided to award the Fellowships for the year 1953-54 in the following subjects:

Two Fellowships in Medicinal Sciences, preference being given to candidates wishing to study (1) Pathology, and (2) Bacteriology;

One Fellowship in Engineering, preference being given to candidates wishing to study Mining Engineering or Chemical Engineering;

One Fellowship in Natural Sciences, preference being given to candidates wishing to study Animal Husbandry; and

One Fellowship in Social Sciences, preference being given to candidates wishing to specialise in the Statistical Study of the

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The Fellowships are intended for men or women of first-rate intellectual and personal qualities, who have already shown unusual capacity to advance knowledge and teaching in one of the fields concerned. Candidates must be Indian nationals, normally between the ages of 25 and 40 years, and must be University Graduates holding, preferably, a Master's or Doctor's Degree, and having subsequently had a year or more of teaching or research experience on the staff of a University or comparable institution. It is estimated that the total value of an award (exclusive of travelling expenses) will be at the rate of from £770 to £890 a year (sterling), according to individual circumstances.

The Fellowship will be awarded by the Trustees of the Foundation on the recommendation of its Advisory Committee in India. Applications for Fellowships for 1953-54 (one original and three copies) should be submitted not later than 15th January, 1953, to the Secretary, Nuffield Foundation Indian Advisory Committee, Planning Commission, Rashtrapati Bhawan, New Delhi, from whom copies of the form of application may be obtained.

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## INDIAN NATIONAL SCIENTIFIC DOCUMENTATION CENTRE

THE Indian National Scientific Documentation Centre, recently set up in New Delhi by the Government of India, under the auspices of the Council of Scientific and Industrial Research with assistance from the UNESCO has started active work already.

The most important function of the Centre is to receive and retain all scientific periodicals acquired in India, to supply photographic copies, translations and abstracts of articles required by laboratories or individual workers, and to be a national repository for reports of the scientific work of the nation. It is also intended that through this Centre the scientific work of India will be made known and made available to the rest of the world.

As a basis for the operation of the Centre a large number of journals, especially those dealing with the physical sciences, have been ordered and are being received regularly. In addition, nearly 12,000 books are also available for reference in the N.P.L. Library. With these journals and by borrowing other journals and books

available in the Delhi area, INSDOC is able to attend expeditiously to enquiries for bibliographies on specific subjects or to supply a photographic copy on paper or microfilm of most scientific papers. The Centre will also, if necessary, obtain copies of articles from abroad if the journals in question are not available in India. Translations into English are made from German, French, Russian, Czech, Italian, Spanish, Portuguese, Dutch, Danish, Norwegian and Swedish.

The INSDOC Documentation Centre levies small charges for making available its services to scientific institutions and research workers. The charges are lower than those levied by the documentation centres abroad. The object is that the services of the INSDOC should be availed of by as many scientific workers as possible. Some microfilm readers supplied by UNESCO are also available with the Centre. These are rented out to scientific institutions, universities, etc., both in Delhi and in other regions of India.

## A STUDY OF SOME PALAEOOLITHIC ARTIFACTS FROM SOUTH INDIA

MRS. B. ALLCHIN

*(Institute of Archaeology, London University)*

THE specimens described in this paper are from the collections preserved in the Geology Department, Central College, Bangalore, consisting of (a) artifacts collected by Professor L. Rama Rao and his assistants at Velaungudi, Trichinopoly Dist.; (b) artifacts collected by the late Professor P. Sampat Iyengar near Kibbanhalli in Tiptur Taluk, Mysore State; and (c) a number of small groups of artifacts from various other sites mainly in Mysore and Madras. I have made a detailed study of the two larger groups only, as there did not seem to be sufficient examples in the other groups to indicate the range of tool types. On the whole, however, the typology of the smaller groups appears to follow that of the larger very closely.

Professor P. Sampat Iyengar published an account of the finds from Kibbanhalli site together with a description of the site in a paper read before the Geological Section of the Indian Science Congress in 1924, entitled "A Palaeolithic Settlement and Factory in Mysore State". He divides implements of various degrees of skill of manufacture into Eoliths, Palaeoliths, and Neoliths, and considers that the site was occupied continuously during all these phases. In the light of more recent discoveries, however, it appears unlikely that this is the case, as it would mean continuous occupation for tens of thousands of years. He also mentions that he found no actual sites of habitation. It seems more probable, therefore, that this is simply a palaeolithic factory site similar to those found in Africa. These sites are strewn with artifacts in varying stages of completion which have been for some reason—such as unsuitability of stone—discarded by the makers, hence the 'Eoliths'. I could not see any implements in the collection which could be classed as true Neoliths.

Two papers by K. Sripada Rao describing in all eleven implements from the Central College collection in great detail appeared in the *Journal of the Mysore University*.<sup>1</sup> The author includes suggestions on how the implements may have been hafted.

The artifacts from both Kibbanhalli and Velaungudi closely resemble those found in other parts of India. Those in the Kibbanhalli collection particularly, resemble specimens found by Bruce Foote at Attirampakkam in the

Chingleput District of Madras, and other sites in Madras State, nearly all of which are made from the same material, quartzite. The Trichinopoly artifacts are made largely from chert, and have certain slight differences which can be seen in the photographs, as chert has a much finer cleavage than quartzite. Both groups, however, show the same general forms and technique of manufacture. The quartzite artifacts are very similar to tools found in large numbers in South Africa.

Some of the forms found at these sites have an almost world-wide distribution. The hand axe occurs from South Africa to North-West Europe and to South-East Asia. The cleaver also occurs in all these areas, but in relatively smaller numbers in Europe in proportion to the number of hand axes.

I have classified the artifacts according to the terminology most widely used today, but I have not given detailed description of the form and manufacture of the types mentioned as this has been very fully done by a number of authorities, perhaps most recently and clearly by Kenneth P. Oakley in "Man the Toolmaker", published by the British Museum (Natural History Section). For those types with which Oakley has not dealt, I have given notes or other references.

The following list includes all the tools of the two groups:

*Kibbanhalli Tool Types (all quartzite except where stated)*

*Cleavers*.—18 (11 on cores, 7 on flakes, 1 broken specimen of quartz).

*Hand axes*.—52 (28 on cores, varying from 2"-9" in length, 5 of the smallest being of quartz).

*Rostro-carinates*.—10 (1 of quartz).

*Discs*.—34 (22 on cores, 12 on flakes. 1 is of dolerite. There is a great variety of size and thickness, grading into the chopper-tools).

*Chopper-tools*.—43 (All on flakes, which are mostly of large rough clactonian type).

*Concave (Hollow) Scrapers*.—16 (all on medium-sized coarse flakes; they include 1 with two concave cutting edges, and also 2 considerably smaller specimens one of quartz and one of agate).

*Small Core Scrapers*.—3.

*Blade Cores*.—8 (one chert and one chalcedony).

<sup>1</sup> July 1930, 4, No. 2, and January 1932, 6, No. 1.



*Small Flakes.*—34 (all showing signs of use as points scrapers, etc., 7 of quartz).

*Digging Tools* (?).—2.

*Fabricators* (?).—3.

*Borers.*—20 (4 on cores, 16 on flakes. 2 quartz, great variety from long points and concave sides—most extreme on flakes, to small rostro-carinate like specimens—most extreme on cores).

*Velaungudi Tool Types* (all chert except where stated)

*Cleavers.*—4 (all on flakes, one granite).

*Hand axes.*—23 (9 on cores, including 3 very small, and 2 large almost rostro-carinate in form. 14 on flakes, 8 very small, i.e., under 1½" and 6 1½"-3").

*Discs.*—3 (on cores).

*Chopper Tools.*—25 (3 on cores, remainder flakes).

*Hollow Scrapers.*—18 (all on flakes varying greatly in size).

*Square Scrapers.*—5 (all with straight cutting edge).

*Flakes.*—41 (all showing signs on use as points and scrapers).

*Fabricators* (?).—3.

*Borers.*—7 (all on flakes except one, 3 being extremely large and crude).

It will be seen that the divisions in these lists are somewhat arbitrary; in reality the various tool types grade into one another almost imperceptibly, and it is often very difficult to decide where to draw the line. In the photographs the tools are arranged in series so as to illustrate this.

*Plate I* shows cleavers and hand axes. 1-8 are reasonably well finished and show the

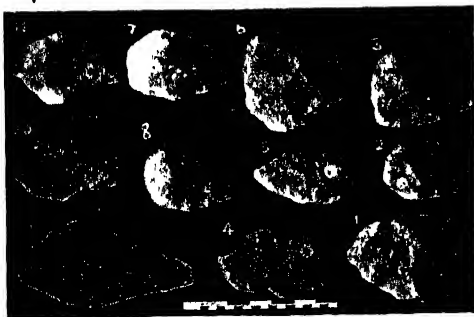


PLATE I. From Kibbanhalli, Tiptur Taluk 1-3. Cleavers on cores. 4. Cleaver on flake (flake surface uppermost). 5. Hand axe on flake (flake surface uppermost). 6-7. Hand axes on cores. 8. Hand axe on pebble. 9. Rostro-carinate. 10. Hand axe (?) on thin slab of rock. 11. Hand axe-borer on flake,

cleaver in process of transformation into the hand axe. 9-11 are much cruder, 9 showing only doubtful signs of human workmanship. 10 and 11 it will be seen bear considerable resemblance to No. 6 in Plate II.

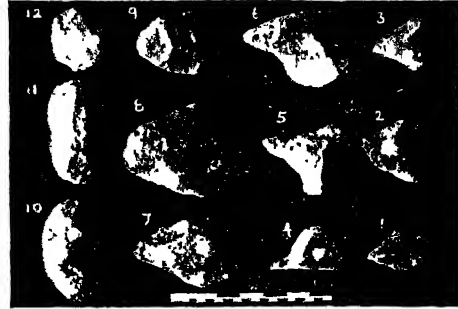


PLATE II. From Kibbanhalli, Tiptur Taluk. 1-5. Borers on flakes and cores (the point of 2 having been broken in use). 6. Hand axe-borer on core. 7. Hand axe on core. 8. Hand axe-cleaver on core. 9. Hand axe disc on core. 10-11. Discs on cores. 12. Disc on flake.

*Plate II* shows an even more extensive series: a disc on a flake which might almost be classified as a chopper tool; two oval shapes classed as discs, on cores; one artifact representing the half-way stage between disc and cleaver but classed as cleaver; one hand axe with a tendency to concave sides, and leading on from this a series of diminishing borers.\*

*Plate III* presents three particularly interesting specimens (1, 4 and 5). They appear to be blade cores from which long narrow blades have been struck, as opposed to flakes like those in Plate IV. No blades are to be found in Professor Iyengar's collection; so presumably they were either overlooked at the site, or taken away by the makers and lost. These cores are very similar in form, and differ only in size from microlithic blade cores found all over India. This plate also includes two curious long curved tools Nos. 2 and 3 (those classed by Professor Iyengar as neolithic). The curved shape appears to me to be due to some peculiar line of cleavage in the rock. Judging by the use marks on the pointed ends they were used as digging tools. Finally 6 and 7 I have classed as fabri-

\* *The Borer.*—I have used this term to describe a tool which resembles a small hand axe with concave sides and a point sometimes exceedingly long and sharp, and bearing use marks on the point in most cases. This type seems to be peculiar to South India.



PLATE III. From Kibbanhalli, Tiptur Taluk. 1, 4 and 5 are blade cores (blade scars indicated). 2-3. Curved digging tools (?). 6-7. Fabricators (?).

cators. They both show considerable signs of battering against hard objects at either end, and possibly were used in the manufacture of other artifacts.†

Plate IV shows two concave-sided points on flakes (1 and 2) which can be classed as borers, three small flakes showing signs of use one as a point and two as side scrapers (3-5), and three large concave scrapers on coarse flakes,



PLATE IV. From Kibbanhalli, Tiptur Taluk. 1-2. Concave sided points on flakes. 3. Flake (showing signs of use on point). 4-5. Flakes (showing signs of use as side scrapers). 6-8. Concave scrapers. 9. Disc on core. 10-11. Discs on flakes. 12-14. Chopping tools on coarse flakes.

the central one having two notches in the cutting edge and the others one each. Finally two discs on flakes (10 and 11), and four on cores (9, 12-14).

† Tools of this nature are described by L. S. B. Leakey in various accounts of the archæology of East Africa.

Plate V shows a series of hand axes from the Trichinopoly site, including the two peculiarly elongated specimens mentioned in the list above, which, like No. 9 in Plate I, appear to be partly finished hand axes abandoned before completion.



PLATE V. From Velaungudi, Trichinopoly. 1-11 Series of hand axes.

I have included a number of very small artifacts under the heading hand axes, simply because the only way in which they differ from the larger specimens is in size. It is, therefore, quite impossible to make any clear division into two classes, although the smaller ones might be better described as points.

Plate VI shows three large chopping tools, 1 and 3 on flakes, and 2 on a core. 4-7 belong to a class of scrapers on flakes peculiar to this group of tools: they are roughly square, thin



PLATE VI. From Velaungudi, Trichinopoly. 1 and 3. Chopping tools on flakes. 2. Chopping tool on core. 4-7. Square scrapers on flakes. 8-10. Cleavers on flakes. 11. Disc-cleaver on flake.

flakes with an almost straight cutting edge. 8-10 are all cleavers on flakes—the difference between 8 and 4-7 not being a great one. 12 is a disc-like cleaver on a flake,

Plate VII shows one possible fabricator (2). Although in form it is rather different from those from Kibbanhalli it has very similar battering on both ends. 1 and 3-7 are hollow scrapers on flakes. The flakes vary greatly in size

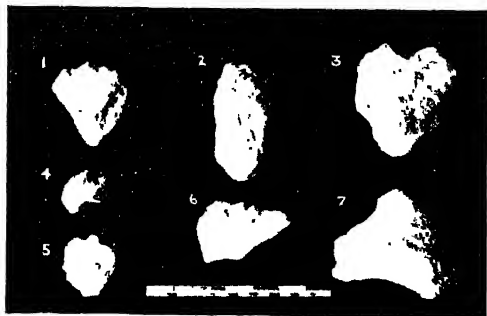


PLATE VII. From Velaungudi, Trichinopoly. 2. Fabricator (?). 1 and 3-7. Hollow Scrapers on flakes.

do the hollow scraped edges. Several, it will be seen, have two hollows and a kind of 'beak' between them.

The difference in size of artifacts from the two sites is due to the fact that the chert in the Velaungudi area occurs only in nodules of limited size, whereas quartzite can be obtained

Kibbanhalli in lumps of almost any size from outcrops at the site. Also the finer cleavage of chert allows for much finer flaking, and this fact makes possible the manufacture of the square scrapers with straight cutting edges mentioned above. In both cases the artifacts are found at the places where the raw material occurred. Palæolithic man in this part of the world, like his relations in South Africa appears to have come to the place where suitable stone was to be found, and made his tools

there. In this way he differs from the Neolithic inhabitants of the Deccan who often brought their raw materials for the manufacture of 'celts' and microliths considerable distances, sometimes many miles, to their homes, and made the tools there. This difference appears to be due to two causes. In the first place it is probable that palæolithic man had no permanent home. Where caves occur he no doubt occupied them, as in other parts of the world. But even this was probably only at certain seasons of the year. Like the South African bushman of today, he was in all probability a wanderer. Small groups followed the herds of game in their seasonal migrations, sleeping in the open, or building temporary shelters of sticks or leaves. But like the animals they hunted, they wandered within limits, returning to certain places at approximately the same time every year. In this way it seems probable that the same group returned regularly to their factory sites, and made a supply of artifacts, which they took away with them, leaving behind waste material and imperfect or incomplete specimens. Another reason why they made the artifacts on the spot is that their method of working entailed a large amount of waste, therefore, they would have had to carry away an enormous weight of unwanted stone. This again was different in the case of neolithic man who was far more economical in the use of raw materials.

In conclusion I would like to extend my sincere thanks to Professor L. Rama Rao for putting the material at my disposal and for his kindly advice and aid, without which this study would not have been written. I should also like to thank the members of the staff of the Geology Department, Central College; and my husband who has helped me in many ways.

#### JOURNAL OF THE BOMBAY NATURAL HISTORY SOCIETY

THE *Bombay Natural History Society Journal*, which has maintained uninterrupted publication for the last 66 years, completed its fortieth volume with the present issue. This is an occasion for justifiable pride. From its beginnings—four parts of Vol. I published in 1886 contained only 234 pages—it has grown to imposing proportions, the average number of pages in the last 10 volumes being 774. For

a natural history publication conducted by a private society purely out of revenues derived from its membership subscriptions, with practically no financial aid from Government or extraneous sources, this is indeed a praiseworthy achievement.

We extend to the *Journal* our heartiest good wishes for a future even more splendid than the past.

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ON CLOSED PROTON SHELLS IN  
NUCLEI OF ATOMIC NUMBER LESS  
THAN FIFTY

RECENTLY the single particle model<sup>1-5</sup> has come into much prominence. Many nuclear properties are fairly well explained according to this scheme. The most important basis for the model, however, is the occurrence of magic numbers whose existence now seems to be well established. That neutron or proton numbers 2, 8, 50, 82 and neutron number 126 give particularly stable structure, can now be affirmed with a good amount of certainty.<sup>6</sup> All the different nuclear models are also formulated in a way so that they give closed shells at these numbers. But theory predicts the occurrence of a number of other shells or subshells at different magic numbers. Empirical evidence also shows greater or smaller stability at neu-

tron or proton numbers 20, 28 and proton numbers 14 and 58.<sup>7,8</sup> Though there is some doubt as to the particular stability at 20<sup>9</sup> and the evidence for 14 and 28<sup>10</sup> is not very convincing, yet it is highly probable that these numbers must be representing the closing of at least some subshells. Recent investigation of Ståhelin and Preiswerk<sup>11</sup> gives in addition to the numbers already mentioned 38, 64 and 92 as possible magic numbers. Duckworth and Preston<sup>12</sup> give some evidence to show probable magic characteristic of neutron numbers 16, 32 and 70 and proton number 40. From a study of  $\alpha$ -ray systematics Sengupta<sup>13</sup> concludes the existence of proton subshells at  $Z = 88$  and 92.

It was noted by Elsasser<sup>14</sup> that the distribution of the number of stable isotopes for even atomic numbers shows a periodic variation

with  $Z$ . Since his work, several new isotopes have been discovered and it is worthwhile to re-examine the variation, especially because we can get some idea regarding the stable proton shells from a study of this curve. In Fig. 1 number of stable nuclei

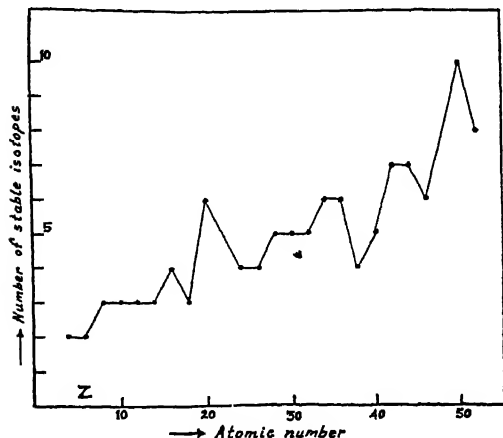


FIG. 1. Variation of the no. of stable nuclei with  $Z$ .

is plotted against even  $Z$  for  $Z \leq 50$ . Data are taken from Rosenfeld.<sup>15</sup> The well-known fact that the number of stable isotopes increases with  $Z$ , can be easily noticed. There are however sharp fluctuations superposed over this general trend. At  $Z=16, 20$  and  $50$  we get peaks and at  $Z=8, 28, 34$  and  $42$  we have a sudden increase in the number of stable isotopes. This evidently signifies some stability of nuclei with the particular number of protons.

As already pointed out, both theoretical and empirical evidence for closed shells at  $8, 20, 28$  and  $50$  are well-known. According to Mayer's scheme<sup>1</sup> both  $16$  and  $34$  should also be magic numbers owing to the filling up of  $2s_{1/2}$

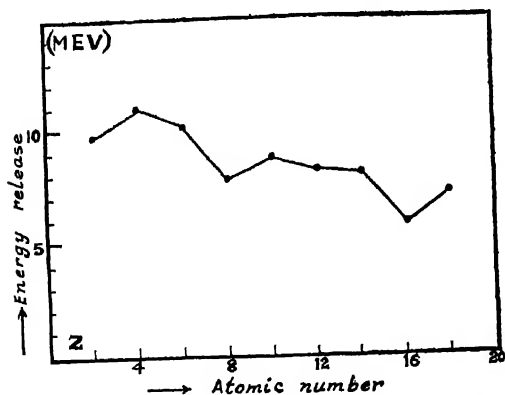


FIG. 2. Energy release for the addition of on odd proton to an even  $Z$  nucleus shown against  $Z$ .

and  $1f_{5/2}$  levels. Stability of proton number  $16$  may also be deduced from Fig. 2, where energy release for the addition of an odd proton to an even  $Z$  nucleus is plotted against  $Z$ , for nuclei with neutron excess  $2$ . Data have been taken from Rosenfeld.<sup>15</sup> From the figure, distinct minima are noted at  $Z=2, 8$  and  $16$ . The apparent stability of  $Z=42$  should perhaps be ascribed to the completion of the subshell  $2p_{1/2}$  at  $Z=40$ , for which some stability has been observed by Duckworth and Preston.

Krishnagar College,

S. SENGUPTA.

Krishnagar,

W. Bengal,

July 23, 1952.

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## THE BLUE BANDS OF BENZALDEHYDE

BANDS similar in appearance and wave-lengths, to those recorded by Stewart and others<sup>1</sup> have been obtained in the spectrum of a suitably controlled transformer discharge through flowing benzaldehyde vapour. The typical spectrogram reproduced here was taken on a glass three-prism Steinheil spectrograph with its large aperture camera ( $f/2.8$ ) on a Kodak P.1200 plate with 5 hours exposure to a transformer discharge through flowing vapour of benzaldehyde. The flow of the vapour and the voltage of the transformer were adjusted such that the glow obtained was always maintained at a faint bluish colour.

Most of the bands are broad and diffuse but a few of them show a clear degradation towards the longer waves marked R in Table I and occur with an intensity comparable with that of the Angstrom bands which are also present on the plate. There are a few narrow bands on the extreme long wave-length side of the plate which are also degraded towards the red and which from their structure appear to belong to a different system and probably to a different emitter (CN?).

TABLE I

$\lambda$ air	Int.	Description	$\nu$ vac.	Stewart <sup>1</sup> $\nu \times 10^{-1}$
(3940)	0	Broad, diffuse	(25374)	2533
3971.2R	5	Broad	25174	2516
4011.9R	1	Broad	24919	2494
(4247)	0	Narrow, diffuse	(23530)	2364
4266.5R*	10	Broad	23432	2344
4313.1	2	Broad, diffuse	23179	..
4380.2	2	do	223.4	2299
(4587)R	0	Narrow	(21795)	2179
4601.4R†	8	Sharp	21726	2169
4659.7	2	Broad, diffuse	21455	2151
4719.8	1	do	21181	2123
(4958)	0	Diffuse	(20164)	..
4986.7R	5	Sharp	20048	2014
5046.8	2	Broad, diffuse	19809	..
..				
5442.5	3	Diffuse	18369	..

\* High dispersion plates show that this consists of two heads with  $\lambda\lambda 4262.9$  and  $4263.3$  which is again a very close doublet

† Similar remarks as for band at  $\lambda 4266.5$ . The band consists of two heads with  $\lambda\lambda 4598.1$  and  $4603.0$ .

Higher dispersion plates (camera lens  $f = 640$  mm. and aperture  $f/9.1$ ) show that the bands at  $4265.2$  and  $4601.4$  A, are double-headed, each head again being a very close doublet. These and other features are indicated in Table I which gives the band head data obtained in the present experiments. In view of the character of the bands, measurements were made on several plates and these indicate that the accuracy of the wave-lengths is not more than  $\pm 1$  A.U. for the stronger bands. For bands included in the brackets and the last two bands in the Table, the likely error is  $\pm 4$  A.U. For the rest of the bands the probable error is  $\pm 2$  A.U.

Work on these bands is in progress and T. Pradhan<sup>2</sup> has been able to produce them in a spark discharge through flowing benzaldehyde vapour. The present data are deemed to be of sufficient interest to warrant their publication now. The arrangement of the bands (except the one at  $3940$  A.) as given in Table II indicates that they can be comprised into three series each involving a frequency of about  $1740 \text{ cm}^{-1}$  which appears to be associated with the lower state involved in these bands. This is close to one of the fundamental vibrational frequencies of the benzaldehyde molecule as obtained in infra-red<sup>3</sup> ( $1724 \text{ cm}^{-1}$ ) and Raman<sup>4</sup>

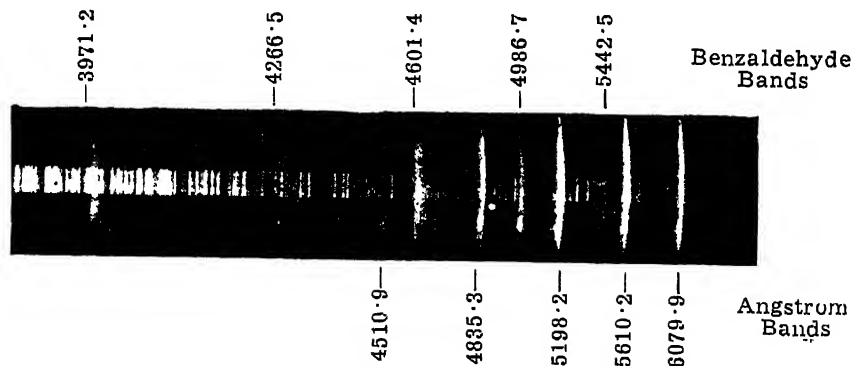


TABLE II

Series arrangement of the wave numbers

I	..	(23539)	1744	(21795)	1731	(20164)			
		1380		1334		1391			
II	..	24919	1735	23179	1724	21455	1646	19809	
		(255)		(253)		(271)		(239)	
		25174	1742	23432	1706	21726	1678	20048	1679
						1369		1372	1936
III	..					22824	1643	21181	
						..		..	

(1701 cm.<sup>-1</sup>) data and forms evidence to show that the bands are probably due to benzaldehyde.

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## GYPSUM DEPOSIT OF GARUR CHATTI, GARHWAL, U. P.

THE existence of gypsum in the district of Tehri Garhwal has been reported by Auden,<sup>1</sup> G. N. Dutt<sup>2</sup> and others. But the deposit of gypsum on the south bank of the river Ganges, near Garur Chatti (78° 20' E/30° 6' N, formerly within British Garhwal), with good potentialities has so far failed to receive any serious consideration.

Massive irregular pockets of gypsum, interbedded with dolomite or dolomitic limestone of the Krol series (trending NW-SE) are located to the south of Garur Chatti, in an area between 78° 18' E/78° 21' E and 30° 6' N/30° 8' N. Deposits are broadly divided into three groups, (a) stratified, (b) irregular pockets, (c) floats. Some of these are well stratified and suggest a considerable degree of replacement of the original bedded sediment. Small-scale displacement is a common feature. The thickness of the deposit varies between 200 ft. and 5 ft. in general and it extends in strike-wise direction for 5,000 ft. in detached lengths. Isolated pockets of variable dimensions are often connected by thin innumerable stringers and veins of snow-white gypsum. The mineral in the stratified

deposit is found to have light greenish white, milk-white, buff or grayish brown colour. The snow-white variety (98-99% CaSO<sub>4</sub>, 2 H<sub>2</sub>O) is of minor occurrence. The light greenish or grayish white variety with good reserve deserves closer consideration. Medium to coarse-grained white crystalline varieties are occasionally present in isolated patches. Chief tectonic impurities associated with them are dolomitic limestone, alumina, iron oxide and silica. Surface deposits or floats are irregularly strewn over hill slopes.

Considerable degree of replacement under static condition helped in concentrating the gypsum in isolated pockets. The structure and composition of the bed rock are highly variable. These together with pH and Eh value and temperature of the lime sulphate solution were few of the important factors controlling the shape, dimension and quality of the deposit.

A rough estimate of the total reserve is 105,000 tons. The deposit is a very promising one and further work of exploration should be seriously taken into consideration. The greatest obstacle in developing the property is, however, the matter of transport and accessibility of the area under consideration.

Gauhati University, ANIL KRISHNA BANERJEE.  
Assam,  
August 8, 1952.

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## CALCULATION OF ELECTRONIC ENERGY LEVELS OF INDENE

ENERGY levels for Indene molecule containing a six and five-membered ring have been calculated adopting Sklar's valence Bond method.<sup>1</sup> Assuming seven canonical structures, the following secular determinant has been obtained:

$$\begin{vmatrix} x+5a/2 & x/4+7a/4 & x/2+2a & x/2+2a & x/2+2a & x/2+5a/4 & x/4+a \\ x/4+7a/4 & x+5a/2 & x/2+2a & x/2+2a & x/2+2a & x/8+7a/8 & x/4+a \\ x/2+2a & x/2+2a & x+a & x/4+7a/4 & x/4+7a/4 & x/4+a & x/2+a/2 \\ x/2+2a & x/2+2a & x/4+7a/4 & x+a & x/4+7a/4 & x/4+a & x/8+7a/8 \\ x/2+2a & x/2+2a & x/4+7a/4 & x/4+7a/4 & x+a & x/4+a & x/8+7a/8 \\ x/2+5a/4 & x/2+7a/8 & x/4+a & x/4+a & x/4+a & x-a/2 & x/2+a/2 \\ x/4+a & x/4+a & x/2+a/2 & x/8+7a/8 & x/8+7a/8 & x/2+a/2 & x-2a \end{vmatrix} = 0,$$

where  $x=Q-E$ ,

With  $\alpha = -1.92$  the roots of the determinant are derived as  $-103.75, -1.92, -6.33, 1.92, 1.53 + 0.69i, 1.53 - 0.69i$ . Rejecting complex roots the following energy values for levels have been obtained.

$$Q + 103.75, Q + 1.92, Q + 6.33, Q - 1.92.$$

Considering the energy level represented by the root  $Q - 1.92$  as ground level and the level represented by root  $Q + 1.92$  as excited level, the energy value of the transition between these two levels is of magnitude 3.84 electron volts, which corresponds to an absorption at  $\lambda 3228$ . The experimentally observed absorption is at  $\lambda 2952$ . Similar calculated and observed absorption regions determined by Sklar for benzene are at  $\lambda 2470$  and  $\lambda 2590$  respectively.

Further details of the calculations will be published elsewhere.

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July 28, 1952.

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# **DOLERITE DYKE NEAR SHIHULIBARI, N. MANBHUM, BIHAR**

NORTH-WEST of the Panchet Hill, beyond the Raniganj Coal Field and west of it, several dykes are seen to occur in the archaean amphibolite country rock, cutting across their structural trends. The megascopic structure and the petrology of one such dyke that lies beautifully exposed on the river Ulla, west of Shihulibari ( $86^{\circ} 44' 40''$ ,  $23^{\circ} 39'$ ), were studied in detail from 16 specimens collected at regular intervals. The dyke is approximately 68 ft. wide.

The dyke trends  $340^{\circ}$  and cuts vertically across the northerly dipping metamorphites which have a general strike of  $70^{\circ}$ . The dyke shows several sets of joints which are comparatively better developed close to the two walls adjacent to the chilled borders. Four sets of joints can be recognized, of which one is horizontal, two vertical with their planes parallel and at right angles to the trend of the wall and the fourth steep dipping and diagonal with respect to the wall. The orientation of these joints show no relation to the structural alignments of the country rocks or to the joints that are seen to have been developed in them.

**Petrography.**—Along the major portion of the width of the dyke the rock is olivine dolerite, and is compact, hard and dark coloured. Considerable variation in grain size can be recognized in hand specimen and the texture becomes

coarser towards the middle. The two chilled borders are basaltic in appearance, while the chief constituents are plagioclase, pyroxene, olivine, magnetite and among the secondary minerals, iddingsite, magnetite, limonite, calcite, stilbite, chalcedony, etc.

The texture of the olivine dolerite is typically ophitic to subophitic. The basaltic chilled borders have phenocrysts of plagioclase and pyroxene embedded in a cryptocrystalline groundmass having a little glass and palagonite; the microlites are of augite and plagioclase. They differ considerably from the main portion of the dyke in their mineralogical composition. They are devoid of olivine. While the pyroxene in the main body is enstatite augite, showing a faint colour ( $2V_z = 44^{\circ}$ ,  $Z \wedge c, 42^{\circ}$ ), that in the chilled borders is more calcic ferri-ferrous augite ( $2V_z = 53^{\circ}$ ,  $Z \wedge c, 44^{\circ}$ ). The plagioclase is labradorite and shows, at places, well-marked zoning.

Apophyses are seen to arise out of the main body of the dyke and traverse the country rocks at various angles. The thin section of one such shows a dark brown to brownish black glass with a few phenocrysts of plagioclase and pyroxene. The pyroxene is decidedly more calcic and ferri-ferrous. In the thin section the apophyses are seen to send thin stringers within the amphibolite and both have incorporated broken xenocrysts of amphibole and xenoliths of the amphibolite assemblage. The stringer is almost completely glassy, with very few fine grained phenocrysts of augite and plagioclase. It continues within the amphibolite as a calcite vein. Similar cross-cutting thin stringers of calcite (sometimes accompanied by quartz) are seen also to arise out of the main body of the apophyses or of the dyke.

The absence of olivine and the more ferri-ferrous nature of the augite in the chilled borders suggest that these phenocrysts crystallized subsequent to the crystallization of those of the central portion. The dyke was emplaced towards the last stage of crystallization when only a minimum liquid was present, sufficient to impart to the rock the required mobility. This liquid, squeezed outwards, was chilled due to the sudden cooling in contact with the wall, into a basaltic rock.

The point of more serious import is the proof that there was a relative enrichment of Fe over Mg and of Ca in the late liquid. This enrichment of Ca is further proved by the presence of calcite in the stringers and of cross-cutting calcite veins. The Ca may have been primary late-magmatic, or it may have been incorporated



from the calc-magnesian metamorphites which appear as a common variant of the amphibolite country rock.

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July 24, 1952.

### PERIODATE OF URANIUM

C. F. RAMMELSBERG<sup>1</sup> found that when uranium tetrachloride is treated with potassium periodate, a greyish green precipitate of uranyl periodate is formed, which soon passes into yellowish-white uranyl periodate,  $\text{UO}_2(\text{IO}_4)_2$ . The authors have found that on adding potassium metaperiodate solution to a warm saturated aqueous solution of uranyl nitrate, a yellowish-white precipitate of  $\text{UO}_2(\text{IO}_4)_2 \cdot 2\text{UO}_3$  is formed. This compound was filtered, washed with hot water till free from nitrate, dried in an electric air oven at 60° C. and analysed. Uranium content of the periodate was determined by the oxine method.<sup>2</sup> Percentage of iodine and available oxygen in the compound were estimated by Kimmins' method modified by Bahl and Partington.<sup>3</sup> The analysis gave (mean of 5 determinations, each being duplicated), U 58.96 per cent.,  $\text{I}_2$  20.83 per cent.,  $\text{O}_2$  10.28 per cent.

On heating the compound decomposes

$\text{UO}_2(\text{IO}_4)_2 \cdot 2\text{UO}_3 \rightarrow \text{UO}_2 + 2\text{UO}_3 + \text{I}_2 + 4\text{O}_2$   
to give 10.46 per cent. of available oxygen. The calculated values of uranium and iodine in this compound are 58.35 per cent. and 20.74 per cent. respectively.

The analytical and calculated values of uranium, iodine and available oxygen in the compound thus agrees with its formula  $\text{UO}_2(\text{IO}_4)_2 \cdot 2\text{UO}_3$ .

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### SPRAY DRYING OF INDIAN GOOSEBERRY JUICE

ADEQUATE supply of ascorbic acid has always been an intriguing problem, as consumption of citrus fruits and fresh vegetables is badly res-

tricted amongst the majority of India's population owing to their high cost. Amla, *Embellica officinalis* (Indian gooseberry) available in plenty during a particular season in India, has been shown to be a rich source of vitamin C.<sup>1</sup> Further, Giri, *et al.*,<sup>2,3</sup> and Damodaran, *et al.*,<sup>4,5</sup> have shown that this vitamin in amla is very stable. Ranganathan<sup>6</sup> observed that dehydrated amla could be powdered and made into tablets. The tablets retained the ascorbic acid activity to a fair degree for about three months. Giri<sup>1</sup> has also described a procedure for obtaining a powder rich in ascorbic acid from amla.

Attempts were made to spray-dry the amla juice using Bowen laboratory spray-dryer. The product was sticky and the recovery was unsatisfactory. Owing to the poor total solid content (below 10 per cent.) of the juice, the feed rate had to be maintained below half a litre per hour with a drying temperature of 100° C. Under these conditions the destruction of ascorbic acid was also high.

It was considered desirable to increase the total solid content of the juice by dissolving common salt to the extent of 20-25%. This liquid was fed at 1½-2 litres per hour. It was observed that a very fine powder of salt collected in the receiver. This powder was not sticky and on analysis showed a vitamin C content of 8.6 mg. per g. of salt. As sodium chloride forms a daily dietary essential, fortification of salt with ascorbic acid in the above manner would afford a safe protection against scurvy, gingivitis, and other symptoms such as weakness, malaise, loss of weight, vague pain in the extremities, slight pallour or anemia and mild changes in temperament which are definitely known to be caused due to lack of ascorbic acid in the diet. Further studies are in progress.

The authors desire to express their thanks to Prof. K. V. Giri for suggesting this investigation.

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July 5, 1952.

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# SEPARATION AND IDENTIFICATION OF SUGARS IN FRUITS BY CIRCULAR PAPER CHROMATOGRAPHY

USING the horizontal migration method of paper chromatography Rao and Beri<sup>1</sup> determined the  $R_f$  values of some sugars. The present investigation deals with the separation and identification of sugars in some fruit juices and honey using circular paper chromatography, recently developed in our laboratory.

The technique used for finding out the  $R_f$  values and for identification by running mixed chromatograms are the same as described by Giri and Rao.<sup>2</sup> For the colour development, the chromatograms were sprayed with aniline hydrogen phthalate.<sup>3</sup> The  $R_f$  values on the circular paper chromatograms with butanol-acetic acid-water, phenol saturated with water, mesityl oxide, collidine saturated with water, ethyl acetate-water-pyridine (2:1:2), ethyl acetate-water-acetic acid (2:1:2), acetone containing 25 per cent. water, and *n*-butanol-water-ethylacetate (2:1:2) as developing solvents were determined. Butanol-acetic acid-water<sup>4</sup> was found to be the most suitable among the developing solvents tried for the identification of commonly occurring sugars like glucose, fructose and sucrose. The relative positions occupied by different sugars when chromatographed using butanol-acetic acid-water as the developing solvent were given below along with their  $R_f$  values.

Sugar	$R_f$ value
Maltose	0.26
Lactose	0.28
Sucrose	0.31
<i>d</i> -galactose	0.35
<i>d</i> -glucose	0.36
<i>d</i> -mannose	0.38
<i>l</i> -sortose	0.40
<i>d</i> -fructose	0.40
<i>d</i> -arabinose	0.41
<i>d</i> -xylose	0.43

It was observed that clear separation can be obtained between sugars having a difference of 0.02 in their  $R_f$  values by adopting the technique of multiple development and running the chromatogram for 25 hr. in each run. A slight difference in the shade of the colour was also observed between the different sugars when developed with aniline hydrogen phthalate which facilitates the identification of them.

The juice from the ripe fruits was prepared by adding alcohol to a concentration of 80 per cent. (v/v) and extracting in a Waring blender.

The solution was filtered and the clear liquid was used for spotting on the paper. In this way glucose, fructose and sucrose have been identified in the fruits of orange, lemon, sweet lemon, banana and in honey. It was not possible to detect sucrose by the ordinary chemical methods while its presence was demonstrated by chromatography. Honey contained a greater concentration of levulose while other fruit juices contained sucrose in higher concentration.

Circular paper chromatography is very handy for the detection of adulteration of honey with sugar sirup as honey thus adulterated will show a definite band of sucrose even if added in very small quantity. It is interesting to note that the minerals and pectins present in fruit juices do not interfere with the movement of sugars. No pre-treatment with resins to remove inorganic impurities was found necessary.

Thanks are due to Professor K. V. Giri, for his keen interest in this investigation.

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## SOME ARYL AND ALKYL-SULPHURYL-BIS-GUANIDINES AS POSSIBLE ANTIMALARIALS

THE discovery of  $N^1$ -*p*-chlorophenyl- $N^5$ -isopropyl biguanide<sup>1</sup> and its unique antimalarial property led to extensive researches in this virgin fields of biguanides and guanidine derivatives. Keeping in view the interesting results obtained by King and Tonkin<sup>2</sup> in the field of guanidines as also the very encouraging pharmacological data obtained in this laboratory with aryl and alkyl guanidine derivatives of sulphonamides,<sup>3</sup> it was considered worthwhile to prepare a series of compounds which would have two guanidine residues linked with the active  $SO_2$  group of sulphonamides.

The following sulphuryl-bis-guanidines of Type I have been prepared.

These bis-guanidine compounds were prepared by reacting 2 mols. of the appropriate guanidine base with 1 mol. of sulphuryl chloride in an inert and thoroughly dry solvent

$\begin{array}{c} \text{R}-\text{NH}-\text{C}-\text{NH}-\text{SO}_2-\text{NH}-\text{C}-\text{NH}-\text{R} \\ \parallel \qquad \qquad \parallel \\ \text{NH} \qquad \qquad \text{NH} \end{array}$		Type I.
R	M.P.	
	Hydrochloride	Base
1 H—	108° C.	91° C.
2 CH <sub>3</sub> —	128° C.	94° C.
3 $-\text{CH}_3 \begin{array}{l} \nearrow \text{C}_6\text{H}_5 \\ \searrow \text{CH}_3 \end{array}$	148° C.	111° C.
4 C <sub>6</sub> H <sub>5</sub> —	152° C.	123° C.
5 <i>p</i> -Cl—C <sub>6</sub> H <sub>4</sub> —	212° C.	181° C.
6 <i>p</i> -Br—C <sub>6</sub> H <sub>4</sub> —	216° C.	183° C.
7 <i>p</i> -(—C <sub>6</sub> H <sub>4</sub> —	232° C.	207° C.
8 <i>p</i> -(Me) <sub>2</sub> —C <sub>6</sub> H <sub>3</sub> —	227° C.	204° C.
9 <i>p</i> -Me—C <sub>6</sub> H <sub>4</sub> —	215° C.	190° C.
10 <i>p</i> -Me—C <sub>6</sub> H <sub>4</sub> —	208° C.	193° C.
11 NH <sub>2</sub> —C <sub>6</sub> H <sub>4</sub> —SO <sub>2</sub> —	197° C.	177° C.

like benzene, acetone, etc. The guanidine bases were obtained from their salts by treatment with molecular proportions of metallic sodium in dry acetone. The free bases of the bis-guanidine salts were obtained by the addition of the requisite amount of dilute alkali, to an alcoholic solution of the salts. Both the salts and bases of the bis-guanidines were crystallised from either alcohol or dilute alcohol.

The compounds are awaiting pharmacological examinations. Full details will be published elsewhere.

Our sincere thanks are due to Dr. B. H. Iyer, M.Sc., Ph.D., for the keen interest shown by him in these investigations.

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## A NEW PRESERVATIVE FOR SUGAR-CANE JUICES

SUGAR factories in India generally add 0.5 g. of mercuric chloride per litre of the juice for purposes of preservation.

The recent work of Gundu Rao,<sup>1</sup> however, shows that 0.5 g. of mercuric chloride per litre of juice can preserve for 10 hours only; this may have to be reinforced by refrigeration for over 24 hours preservation. There are several factories having no refrigerators and there is

thus scope for a definite 24 hours preservative for cane juices in sugar factories.

Introduced recently as germicides and insecticides, the use of D.D.T. and "Gammexanes" rapidly spread in India to several agricultural crops including sugarcane. The other new germicides, namely, some of the quarternary ammonium compounds<sup>2</sup> which are already applied to beat sugar juices are not available in India yet. Therefore, the former products, D.D.T. and "Gammexane", P. 520 were applied to sugarcane juices at the rate of 5 g. per litre to test their antiseptic properties and the results obtained are reported in this note. (Gammexane P. 520 is stated by the manufacturers Mrs. Imperial Chemical Industries Ltd., to contain 50% of benzene hexa chloride, 6.5% Gamma Isomer, the rest being wetting and dispersing agents, fillers, etc.). While D.D.T. preserved juices showed early signs of fermentation the drop in purity being 1.5 units in 8 hours and 10 units in 24 hours, the Gammexane P. 520 preserved juices kept on for over 48 hours. The results obtained with (1) Raw cane juices of high and low density, (2) Clarified sulphitation juice, and (3) Filter press juice (which generally shows signs of fermentation due to stagnation), are tabulated below:

Table showing preservation of different cane juices with gammexane P. 520

Sl. No.	Time in hrs.				Time in hrs.		
	R. Bx.	Pol.	R. Pty.		R. Bx.	Pol.	R. Pty.
Raw Juice, High Density				Raw Juice, Low Density			
1	0 hrs.	17.07	16.03	93.9	0 hrs.	9.83	9.29 94.5
2	17 "	17.07	15.95	93.5	6 "	9.83	9.32 94.5
3	24 "	17.26	16.07	93.1	21 "	9.86	9.32 94.9
4	48 "	17.86	16.69	93.5	45 "	9.96	9.35 93.8
5					69 "	9.86	9.35 95.5
Clarified Juice				Filter Press Juice			
1	0 hrs.	20.5	16.82	82.0	0 hr.	18.83	15.11 80.2
2	7 "	20.32	16.86	83.0	12 "	18.72	15.25 81.5
3	20 "	19.92	16.80	84.3	24 "	18.47	15.8 81.6
4	37 "	20.20	16.74	82.9	36 "	18.62	14.94 80.2
5	50 "	20.42	16.77	82.1	48 "	18.54	15.03 81.1
6	68 "	20.26	16.63	82.1	60 "	18.68	15.04 80.6
7	86 "	20.27	16.61	82.0	81 "	18.66	14.87 79.7

(R. Bx = Refractometric Brix corrected to 28° C  
R. Pty. = Refractometric Purity.)

These figures show that Gammexane P. 520 at the rate of 5 g. per litre keeps raw juices of different densities for well over 24 hours. Its

preservative effect is more pronounced on clear juice and the same effect on filter juice (which is generally a fermenting product) is of particular interest.

The application of this new preservative in all its aspects is under investigation and details will be reported elsewhere. Our thanks are due to Sri. M. H. Prasad and Sri. K. G. Rao, for the facilities provided.

Sugar Laboratory, S. V. RAMANAYYA.  
The Andhra Sugars Ltd., P. J. MANOHARA RAO.  
Tanuku, K. V. RAJU.  
June 26, 1952.

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#### ERROR INVOLVED IN THE GRAVIMETRIC DETERMINATION OF LYSINE IN THE PRESENCE OF HYDROXYLYSINE

TURBAU<sup>1</sup> AND SCHNEIDER<sup>2</sup> have reported two methods for the determination of lysine in proteins; the first based on the precipitation of lysine from purified base solutions as the copper-benzilidene complex and the second dependent on its precipitation as the styphnic acid (2, 4, 6-trinitroresorcinol) derivative after the prior removal of arginine from base fractions.

We had occasion to study these two methods in examining the possibility of using the removal of the lysine complex from gelatin base fractions as a means of concentration of hydroxylysine. This, however, proved impossible for reasons stated below and the isolation of hydroxylysine had to be effected by use of other novel properties of the amino acid.<sup>3</sup>

The present work confirms Turbau's observation that working with pure lysine dihydrochloride the complex (M.P. 232°) separates out in yields of 96-99%, and thus forms a good basis for the gravimetric determination of lysine. Further, as the author reported, casein was found to contain 11.24% of the protein N as lysine. However, when the precipitation of the complex was attempted from base solutions obtained by electric transport of gelating hydrolysate or collagen hydrolysate—collagen and gelatin are the only two proteins found to contain hydroxylysine<sup>4</sup>—it was observed that hydroxylysine also got precipitated quantitatively. Analysis of the samples from various lots, after decomposition with acid and H<sub>2</sub>S, by the method of Van Slyke<sup>5</sup> revealed a hydroxy-

lysine content of 7.5-13%. Recrystallisation of the samples could not materially alter the hydroxylysine content of the samples.

Similarly, having confirmed Schneider's work<sup>2</sup> concerning the use of styphnic acid for precipitation of lysine quantitatively (97-98%) from the phosphotungstic acid fraction, in the presence of 80% of alcohol, its utility as a selective precipitant from gelatin base fractions was sought to be assessed. Here again the co-precipitation of hydroxylysine was observed, the content of hydroxylysine derivative in the various samples ranging from 7.1-10%. Recrystallisation from 50% alcohol led not only to heavy losses, but also the retention of as much as 5-6% hydroxylysine in the sample, though leaving 15-17% of the derivative in the mother liquors.

Likewise, Kurtz's method<sup>6</sup> for the isolation of lysine through the copper benzoyl complex, yields crude benzoyl lysine samples which have a content of near 6.8% of benzoyl hydroxylysine. This proportion is not materially altered on recrystallisation. In converting the benzoyl lysine to lysine dihydrochloride, samples obtained had often a hydroxylysine N content 4.0-6.1%, though in a few cases the content was very negligible.

In view of the above, it would be well to be cautioned against the indiscriminate use of the Turbau<sup>1</sup> and Schneider<sup>2</sup> procedures for lysine determination to proteins or other crude protein products in which hydroxylysine occurs. If at all used, in these cases, allowance may be made for the hydroxylysine present by determination of the same in the samples by the Van Slyke<sup>5</sup> procedure, without resorting to the ineffective procedure of recrystallisation. Also, Kurtz's method<sup>6</sup> of isolation of lysine from gelatin invariably leads to contamination by hydroxylysine and this should be borne in mind when such samples are to be used for analytical, nutritional or other purposes.

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## CHLORINATION OF ILMENITE

ALTHOUGH selective chlorination of ilmenite has been reported by some workers,<sup>1</sup> conditions favourable for the preparation of products containing high content of titanium dioxide and low in oxides of iron do not appear to have been determined before.

In the investigation of the problem, Travancore ilmenite having the following percentage composition was employed:  $\text{TiO}_2 = 60.1$ ,  $\text{FeO} = 11.0$ ,  $\text{Fe}_2\text{O}_3 = 24.8$ . The mineral was powdered to pass through 150 and 200 mesh sieves and then briquetted by the use of various binders, after incorporating different proportions of powdered charcoal together with substances like iron pyrites or coal with high percentage of sulphur, which could be expected to catalyse the reaction of chlorine with the iron oxide present in the mineral. Among the various binders employed, ferric chloride proved to be the most suitable, because it also appeared to promote the preferential chlorination of the iron oxide present in the ilmenite.

Experiments conducted on the above lines employing about 30 g. of ilmenite in each case show that at a temperature of 500-600°C., ilmenite briquetted with charcoal to the extent of about 6 per cent. by using ferric chloride as a binder, yields on treatment with chlorine, residues enriched to over 90 per cent. of  $\text{TiO}_2$  and containing mere trace of iron.

My best thanks are due to Dr. B. Sanjiva Rao for suggesting the problem and Dr. C. C. Patel for guidance during the investigation.

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## MANGANESE METABOLISM

THE author has adduced evidence<sup>1</sup> that manganese is necessary for ascorbic acid synthesis in plants and animals. Among factors which govern the ability of some animal species and inability of others to synthesise ascorbic acid an important one is the reaction in the small gut in maintaining a suitable pH for enzyme activity and favouring the retention of a minimal concentration of manganese by the tissues, the seat of synthesis being the small intestines.

Animal species able to synthesise ascorbic acid usually have a higher manganese content in their tissues than the other group (Table I). This appears to be due to the more acid condition in the small gut of the former group. This communication presents evidence that more manganese is retained by the tissues in acid conditions.

TABLE I  
Manganese content of animal tissues

		mg./100 g. moist tissue		mg./100 g. dry tissue	
		small intest.	liver	small intest.	liver
Man	..	..	..	0.52	0.50
G. Pig	..	0.14	0.16	0.70	0.62
Rat	..	..	0.27	..	..
Rabbit	..	..	0.30	1.16	1.21
Fowl	..	0.26	0.28	1.29	1.05
Goat	..	..	0.35	1.10	1.19

Two groups of albino rats were kept on a basal diet (casein-20; glucose-68; arachis oil-5; cod liver oil-2; salt mixture\*-5) practically free from manganese (0.2  $\gamma$ /g.). They were given daily supplements of synthetic B vitamins. Each individual rat was housed in a Hopkins metabolism cage made of heavily galvanised sheet and wirenetting without rust. 10-15 grams of the dry ration mixed with distilled water were given and consumption was almost full in each case. The animals had *ad lib.* access to distilled water provided in glass bulbs. The rats were given orally 0.5 mg. manganese daily with a pipette. This method of manganese feeding is better than given in the diet. It ensures a sure and constant manganese intake. Possible contamination of the excreta with manganese is excluded as traces of diet falling through cannot significantly alter the manganese content of the excreta. Manganese intake through the diet was negligible and small differences in food consumption had practically no influence on the total manganese consumed.

The animals were kept on this regime for one week to reach a state of equilibrium. On each of the three succeeding days the rats in one group were given 50 mg. sodium bicarbonate each while the rats in the other group were given 16 mg. ammonium chloride each, both by the mouth. 24 hours after the dosing, the urine and faeces were collected on the three succeeding days and analysed for their manganese content by the method of Ray.<sup>3</sup> The

TABLE II  
Manganese excretion and retention by rats (mg./24 hrs.)  
Mn given = 0.5 mg./24 hrs.

Group I (NaHCO <sub>3</sub> )			Group II (NH <sub>4</sub> Cl)			
Excreted			Excreted			Retained
Urine	Faeces	Total	Urine	Faeces	Total	
.012 (.008-.016)	.31 (.25-.41)	.322	.178	.004 (.002-.005)	.193 (.07-.30)	.197 .303

Statistical Analysis:  $t=2.73$ ;  $p=.02-.05$  (significant); degrees of freedom = 5.

result is given in Table II. It is seen that the group given ammonium chloride excreted less and retained more manganese in their tissues. Evidently a more acid reaction in the gut favours the retention of greater amounts of manganese in the tissues of animals. This probably explains why the tissues of guinea pigs, in which the pH in the small gut is higher than that in rats and other animals, are poorer in manganese content. In men the same explanation holds. It is interesting to note that Brückmann and Zondek<sup>1</sup> found only 3 in 13 human livers to have 1 mg. per cent. manganese. It may be noted that the reaction in the small gut of man is variable and is controlled not only by the acid base balance of the diet but also by the nature of its contents. The three 1 mg. per cent. cases might have been taking an "acid" diet while alive.

Part of this investigation was carried out in the Department of Biochemistry, University of Oxford. I am indebted to Prof. R. A. Peters, F.R.S., for hospitality.

Dept. of Biochemistry, M. N. RUDRA.  
Darbhanga Medical College,  
Laheriasarai,  
Bihar,  
June 27, 1952.

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\* NaCl-30; KH<sub>2</sub>PO<sub>4</sub>-30; Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>-30; MgSO<sub>4</sub>·7H<sub>2</sub>O-10.0; FeSO<sub>4</sub>·7H<sub>2</sub>O-5.0; CuSO<sub>4</sub>·5H<sub>2</sub>O-0.15; KI-0.1 trace of NaF. Ca-11 mg./g.; Ca/P-0.91. Use of Fe salt is not contraindicated<sup>2</sup> as the diet contains sufficient vitamin E contained in the arachis oil,

#### A METHOD TO DIMINISH THE AMOUNT OF PIGMENT EXTRACTED FROM URINE BY FAT SOLVENTS IN COLORIMETRIC 17-KETOSTEROID ESTIMATION

To estimate urinary 17-ketosteroids using the colorimetric method of Zimmermann,<sup>1</sup> extraction from acid hydrolysed urine by fat solvents such as ether, benzene or carbon tetrachloride is necessary. Deep red urinary pigments are some of the undesirable substances also extracted. Although the colour due to these pigments is low at the final dilution, it may be necessary to allow for this in a special blank test.<sup>2,3,4</sup> It has now been found that this blank can be avoided when a little copper sulphate is present in the urine before acid hydrolysis. The urine was collected in copper sulphate to prevent formation of inconvenient amounts of ammonium carbonate.<sup>5</sup> Copper sulphate thus serves a double function. Experience with over 70 samples showed that copper sulphate prevents the extraction of the red pigment with carbon tetrachloride. A few urines gave violet extracts even in the presence of copper sulphate, but the red pigment constantly observed when untreated urines were worked up was always absent. Precipitation of "urochrome" by salts of heavy metals was already noted by Berzelius and subsequently by Dombrowski,<sup>6</sup> but this does not seem to have been utilised to obtain lipoidal urinary extracts free from red pigment. Although the precipitate dissolves in acid, the pigment is not thereby rendered extractable by carbon tetrachloride. The copper sulphate should be added to the urine, as neither neutral, acidic nor ammoniacal solutions of copper sulphate remove the red pigment from carbon tetrachloride extracts.

This work has been carried out in the course

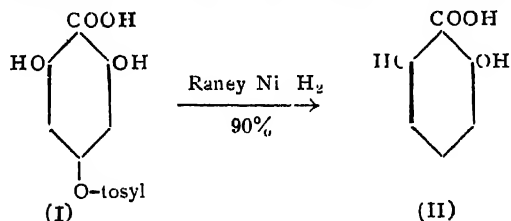
of a scheme on allergic asthma sponsored by the Madras State Research Fund under the guidance of Dr. K. S. Sanjivi.

Biochemistry Dept., HERBERT C. FRIEDMANN.  
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### A NEW METHOD FOR THE PREPARATION OF $\gamma$ -RESORCYLIC ACID (2:6-DIHYDROXYBENZOIC ACID)

It has been stated<sup>1</sup> that sodium  $\gamma$ -resorcyate is more active than sodium salicylate as a therapeutic agent in rheumatic fever. The availability of  $\gamma$ -resorcylic acid has been discussed very recently<sup>2</sup> and Mauthner's method<sup>3</sup> from *m*-dinitrobenzene was chosen for the preparation of the acid; the yield was improved from 5 to 15 per cent. by a slight modification in the final demethylation stage.<sup>2</sup> In the course of our work on Raney nickel reductions<sup>4</sup> we have found that a new and convenient route to  $\gamma$ -resorcylic acid (II) is an application of the method of Kenner and Murray for the cleavage of sulphonic esters with Raney nickel.<sup>5</sup> The desired acid is thus obtained in three stages from phloroglucinol in an overall yield of about 75 per cent. Phloroglucinol carboxylic acid is converted into the mono-*O*-*p*-toluenesulphonyl derivative (I; m.p. 180°, *dec.*), the unhindered hydroxyl group *para* to the carboxyl group reacting, by treatment with 2 mols. of caustic potash and one mol. of *p*-toluenesulphonyl chloride in water at room temperature with shaking until the solution is neutral to litmus and the odour of the chloride disappears (2 hours), followed by acidification. The acid (I) is dissolved in water (300 parts) containing



potassium bicarbonate (0.5 part) and the solution is agitated with Raney nickel (5 parts) for 3 hours at room temperature (29°), while passing a slow stream of hydrogen. The mixture is filtered, acidified with concentrated hydrochloric acid, saturated with salt and ether extracted. By removal of ether and crystallization of the residue from water  $\gamma$ -resorcylic acid (II) is obtained as colourless needles, m.p. 166-67°, undepressed by a sample prepared by Limaye's method.<sup>6</sup> A further quantity of the acid is recovered by treating the nickel residue with hydrochloric acid and extracting with ether (combined yield 90 per cent.).

Our thanks are due to Imperial Chemical Industries Ltd. (Dyestuffs Group), for the award of a Fellowship to one of us.

Dept. of Chem. Tech., V. RAMANATHAN.  
University of Bombay, K. VENKATARAMAN.  
September 12, 1952.

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### ACTIVE RELAXATION OF UNSTRIATED MUSCLE

UNLOADED unstriated muscle relaxes under certain conditions.<sup>1-7</sup> If adrenaline is added to saline in which are immersed unloaded transverse pieces of the stomach muscle of the frog, *Rana tigrina*, or virgin guinea pig's uterus, they lengthen. This may be due to two causes: (a) active relaxation, (b) something pulling it out, such as elasticity of connective tissues or membranes, etc. If the latter explanation is correct, it means that the muscle is loaded and relaxation really passive. To test this the muscle is treated with those agencies which hasten relaxation of a visibly loaded muscle, but retard that of an unloaded muscle. These are: (a) asphyxia, (b) sodium cyanide (1 in 10,000), (c) iodoacetic acid (1 in 10,000), (d) gradual lowering of temperature from 30-37° C. to about 5-10° C. All these procedures diminish metabolism and hasten relaxation of a loaded muscle even if the load is very light. Thus loaded hen's gut, guinea pig's uterus and human appendix relax when asphyxiated at 37-38° C., or if treated with sodium cyanide or iodoacetic acid or on lowering of temperature; unloaded muscles do not relax at all. Loaded dog's stomach muscle from the cardiac end also

relaxes under above conditions, as it usually shows lactic tone; muscle from pyloric end may not relax as it usually shows alactic tone. Dog's stomach muscle may be continuously stimulated with potassium chloride (this ion is suitable as it produces sustained tension) and then asphyxiated or treated with sodium cyanide, when it promptly relaxes if loaded but not if unloaded.<sup>4</sup> Frog's stomach muscle from the cardiac end, when treated with the above four agencies, also relaxes if loaded but not if unloaded; it is usually experimented upon at 25-30° C., though at higher temperatures also, the results are similar.

The above experiments show that such extraneous factors as elasticity of connective tissues, membranes, fluidity of muscle, etc., are of no significant importance in the lengthening of an unloaded unstriated muscle. Further, it has been shown that for a loaded muscle to lengthen, the load must exceed a certain minimum value;<sup>11</sup> so, if the elongation of an unloaded muscle was passive, the force producing the elongation must exceed the above minimum value and the muscle, when immersed in saline, should gradually lengthen; but exactly what happens is the opposite.

Sodium cyanide (1 in 10,000) paralyzes frog's stomach muscle and the guinea pig's uterus and activity is partially restored with 0.1 p.c. glucose. Relaxation of these unloaded muscles is also abolished by cyanide and partially restored with glucose. These and the above experiments conclusively prove that the lengthening of an unloaded muscle is due to active relaxation during which metabolic processes are involved.

There are other subsidiary experiments which support the above conclusion that one kind of relaxation in unstriated muscle is active. The muscle may contract when asphyxiated or treated with sodium cyanide. The immediate contraction is usually due to asphyxial hyperexcitability and to anaerobic metabolism, as glucose increases it. The later contraction on asphyxiation is decreased by glucose, the effect of which is abolished by iodoacetic acid. The muscle may be completely relaxed by glucose and hence relaxation appears to be active.

It is well known that isolated unstriated muscle contains much smaller quantities of glycogen, lactic acid, creatine phosphate and adenosine triphosphate than skeletal muscle, in spite of the fact that it is tonically contracted and it may further contract on exhaustion. In conformity with these findings are the facts that unstriated muscle may use less oxygen

and produce less lactic acid when tonically contracted and behave in an opposite manner when relaxed.<sup>8,9,10</sup> Oxygen consumption and allied experiments may be complicated by the fact that a particular substance or length may have some specific effect on metabolism not related to relaxation or contraction. In some experiments these complicating factors can be excluded. For example in frog's stomach muscle, ammonium ions at pH 7 produce relaxation and increase its oxygen consumption and production of lactic acid. The experiment is performed under isometric conditions and even if there is any increase in length of the muscle during relaxation, this is not the factor to cause increase in metabolism, as increase in length in this muscle at pH 7 causes a decrease in metabolism.<sup>9</sup>

Any apparent relaxation due to arrangement of fibres in a muscle has been excluded by many different kinds of experiments. In the pharyngeal retractor of the marine worm *Phascolosoma*, there are only parallel bundles of longitudinal fibres. In pieces of transverse muscle of the frog's stomach, effects due to contraction of longitudinal fibres are excluded by the following experiments: (1) Both longitudinal as well as transverse fibres may lengthen. (2) The experiment can be repeated several times on the same piece of muscle, relaxation and contraction occurring on addition and withdrawal of adrenaline respectively. If elongation was due to contraction of the fibres at right angles and relaxation be passive, this could happen once only. (3) A tiny piece of the transverse coat can be cut off and relaxation watched under a microscope on addition of adrenaline. (4) The middle part of the frog's stomach contains least longitudinal fibres and it lengthens most; so that, as expected, the longitudinal fibres hinder rather than promote relaxation. The guinea pig's uterus will show relaxation if split longitudinally from end to end. The experiment can be repeated as in frog's stomach muscle and relaxation of a small piece of longitudinal fibres noted under the microscope.

In transverse pieces of dog's stomach muscle, elasticity of connective tissues and complex arrangements of muscle fibres may play a part in producing relaxation. An unloaded piece is first stimulated with alternating current, and the extent to which it can contract and then relax is noted. The same amount of sustained shortening is then produced by potassium ions, and the muscle asphyxiated or treated with sodium cyanide. The extent of lengthening is



noted and percentage of relaxation due to these extraneous factors calculated. This may amount from 5 to 100 p.c. This phenomenon occurs at about 20° C., a rather unusual temperature, for mammalian tissues, and is absent at high temperatures as mentioned above, though a loaded muscle relaxes more readily. The relaxation at 20° C. is, therefore, due to some other cause, probably to the dissociation of metabolic mechanisms for contraction and relaxation. At this temperature, the source of energy supply for contraction is more aerobic than for relaxation, so that cyanide or asphyxia stops the stimulating action of potassium, and the muscle relaxes actively as on cessation of stimulation.<sup>12</sup>

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Agra,  
August 6, 1952.

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#### A TECHNIQUE FOR DETERMINING ACCURATELY THE AREAS OF CONTACT OF THE BODY OF INSECTS IN LOCOMOTION WITH THE GROUND SURFACE

KENNEDY, *et al.*,<sup>1</sup> emphasised the greater effectiveness of the toxic material (Dinitro-ortho-cresol DNOC) when applied to the legs than to other parts of the body of *Locusta migratoria migratorioides* R & F. Areas of the legs being the primary regions which come into contact with the walking surface sprayed or dusted with insecticides. Slifer<sup>2</sup> biometrically measured the ratio of arolium length to claw in various sub-families of Acridiidae in order to estimate the degree of contact made by the plantar surface of arolium to ground level.

No attempt, however, has so far been made to ascertain the extent of such areas of contact in a living insect. The present authors have evolved a technique which would estimate accurately the extent of areas of contact of legs or part thereof to the ground surface in the case of *Schistocerca gregaria* Forskal, while the insect is in normal locomotion.

Various methods, *e.g.*, making the insect

under test to walk over well-inked glass plates or plates thinly covered with fine talc and subsequently examining the organs for impressions were tried. With an insect of frequently jumping habit of the type of *S. gregaria* (adults and mature nymphs), both the methods were found to be messy and useless for, while attempting to jump, the insect would frequently slip thereby spilling the ink or scattering the fine powder all over the body. Moreover, these test-insects being true phytophils did not naturally like walking over smooth or wet surfaces. An indirect method, therefore, had to be adopted and the following technique evolved. The entire plantar surface of the tarsus and pretarsus (with appendages) of each side was painted thinly with a semi liquid adhesive cement ('Tenasitine', a product of Kay Brothers Ltd., Stockport, England) with a very fine brush and the insect allowed to walk normally over a fairly big sized coarse blotting paper, under cover of a glass cylinder for about fifteen minutes. The insects were then taken out and the tarsus, pretarsus along with euplantulae and arolium, were thoroughly examined under a binocular microscope for tracing out the fibres picked up from the surface of the blotting paper by the portions of leg covered by the adhesive cement which had come into contact with the blotting paper. On an exa-



FIG. 1. Tarsal segments of *Schistocerca gregaria* Forskal. Positive areas of euplantulae indicated by white streaks of fibres. F. M. H.—Fore-, Mid- and Hind-tarsi.

mination of the dissected out legs, it was found that whereas fine fibres could be very easily traceable in groups on the euplantular surfaces of the tarsus, no fibre could be traced on the arolium of the pretarsus (Fig. 1). Unfortunately, as the height of the jar used was insufficient, the effect of jumping on the arolia could not be determined for the present. It is thus evident that the tarsi (more particularly the euplantular surfaces) play a very significant role in *S. gregaria*, in picking up the particles of an insecticide and their subsequent transference to hypodermis.

Besides the plantar surfaces of the legs other parts of the body, viz., parts of some thoracic and abdominal sternites appear also to come in contact with the ground or other surfaces during their normal course of activity and thus get abraded.

Experiments are being conducted to ascertain such areas in *S. gregaria*, both adults and hoppers of various stages.

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New Delhi, May 6, 1952.

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### SOME NEW HOSTS AND CONTROL OF THE LANTANA BUG

THE Lantana Bug, *Orthezia insignis* Douglas (Coccidæ: Homoptera), is a widespread phytophagous insect, which is known<sup>1,3</sup> to occur all over South India as a common pest on a wide range of host plants—both wild and cultivated.

Green,<sup>2</sup> who has described *O. insignis*, gives a list of its host plants in Ceylon. Morrison<sup>4</sup> lists a number of host plants based on distribution records of the pest. In India Ramachandra Rao<sup>5</sup> and Kannan<sup>6</sup> record it on 50 different cultivated plants and 6 weeds. Recently it has been observed in Bangalore on no less than 30 new host plants of economic importance. These latter are:

*Medicinal plants*.—*Adhatoda vasica*, Nees (Acanthaceæ), *Barleria cristata*, L. (Acanthaceæ), *Brassica nigra*, Koch. (Cruciferae), *Clerodendron inerme*, Gaertn. (Verbenaceæ), *Indigofera* sp. (Leguminosæ), *Lucas aspera*, Spr. (Labiatae), *Nyctanthes arbortristis*, L. (Oleaceæ), *Ocimum sanctum*, L. (Labiatae),

*Ruta graveolens*, L. (Rutaceæ), *Spilanthes acmella*, Murr. (Compositæ), *Vallisneria spiralis*, Wall. (Apocynaceæ), *Vinca minor*, L. var. *alba* (Apocynaceæ) and *Vitex negundo*, L. (Verbenaceæ).

*Horticultural and vegetable plants*.—*Achimenes* sp. (Gesneraceæ), *Amarantus Gangeticus*, L.—two varieties (Amarantaceæ), *Bignonia* sp. (Bignoniaceæ), *Callistephus* sp. (Compositæ), *Chrysanthemum* (Compositæ), *Coleus* (Labiatae), *Crossandra undulæfolia*, Salisb. (Acanthaceæ), *Ipomœa* sp. (Convolvulaceæ), *Origanum majorana*, L. and *O. vulgare*, L. (Labiatae), *Pilea* (Urticaceæ), *Rose* (Rosaceæ), *Solanum melongena*, L. (Solanaceæ), *Verbena* sp. (Verbenaceæ) and *Zinnia* sp. (Compositæ).

Green<sup>2</sup> rightly remarks that the Lantana Bug is one of, if not the most, resistant of all scale-bugs towards insecticides, and that it is remarkable that the half-grown insects will often survive treatment that has successfully destroyed the younger and older individuals. According to him fumigation with hydrocyanic acid gas is effective, but the treatment is subject to certain dangers and cannot, therefore, be recommended for general use; sprays with insecticidal soap solutions are the next best. Kannan<sup>6</sup> recommends a spray with fish oil soap at the rate of 1 lb. in 5 gallons of water. However, experience has shown that even repeated sprays with insecticidal soap solutions give only partial control. In an attempt to find a more effective insecticide, some of the newer synthetic insecticides were tested, and of these Folidol E. 605 Conc. 46.6 per cent.—diethyl parnitrophenyl thiophosphate—gave the most satisfactory result in that a spray with 0.06 per cent. solution in water gave a 100 per cent. mortality of all adult and early stage bugs within 24 hours in the field; it was non-phytotoxic, and the residual effect was in evidence for nearly 3 weeks. Folidol—E 605 is a product of the Farbenfabriken Bayer, Leverkusen, and is the same as Parathion but with reduced toxicity for man and animals.

We are thankful to Sri. B. Krishnamurti, Government Entomologist, for suggestions and helpful criticism.

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Bangalore,  
August, 1952.

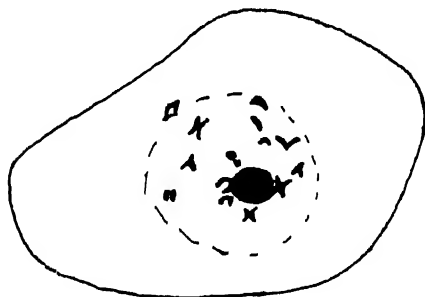
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### MEIOSIS IN *AZADIRACHTA INDICA*

THE meiotic behaviour of *Azadirachta indica* A. Juss. belonging to Meliaceae is reported here as no such information is available for any species of the Meliaceae.<sup>1</sup> The somatic chromosome number of *A. indica* has only been recorded recently as  $2n = 28$  by Pathak, *et al.*<sup>2</sup>

Examination of smears of pollen mother-cells, fixed in Belling's modified Nawaschin's fluid and stained with crystal violet has shown its meiotic behaviour to be regular. The chromosomes pair regularly and form 14 bivalents during diakinesis as shown in the figure. This confirms



Scattered drawing of Diakinesis showing 14 bivalents ( $\times 1,760$ ).

the previous record of the somatic number. The figure also suggests the chromosomes to be quite small in size. Subsequent metaphase and anaphase behaviour is normal.

Thanks are due to Prof. Maheshwari for facilities.

Botany Dept.,  
Delhi University,  
Delhi 8,  
June 30, 1952.

S. K. MUKHERJEE.

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### MORPHOLOGICAL AND CYTOLOGICAL STUDIES OF *ALBUGO* SPECIES ON *IPOMOEA HEDERACEA*

ON the leaves and stems of *Ipomoea hederacea* Jacq. near Bangalore an *Albugo* was collected and investigated. The fungus incited the formation of white powdery pustules on the leaves which were sporangia. On the stems large cerebri-form galls 2 to 2.5 inches in diameter were formed in which the sex organs were developed (Fig. 1). The sporangia measured  $15-19 \times 13-16 \mu$  and lacked the equatorial thickenings

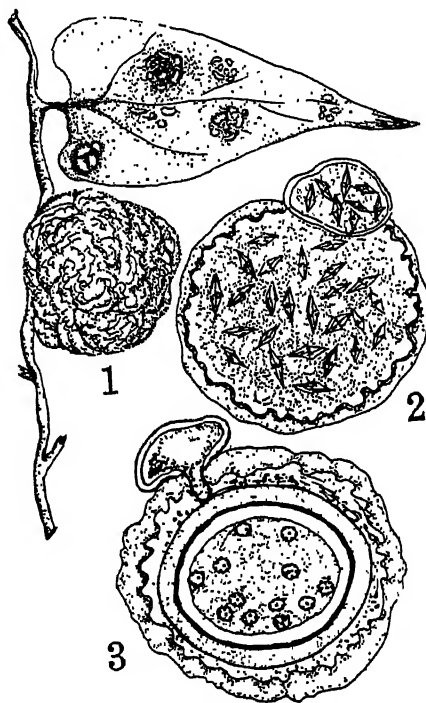


FIG. 1. Habit showing the soreus on leaves and stems,  $\times \frac{1}{2}$ .

FIG. 2. Simultaneous first division in the oogonium and the antheridium,  $\times 400$ .

FIG. 3. Mature oospore,  $\times 400$ .

characteristic of *A. ipomoeae panduranae* (Schw.) Swing. The oospores measured  $44-54 \mu$  in diameter with a mean of  $47.6 \mu$ . The wall of the oogonium was thickened and became confluent with the wall of the oospore in the mature oospore similar to that of *A. evolvoli* (Damle) Safee and Thirumal. The differences in the morphology of the spore forms cross inoculation tests and symptoms produced on the host have been taken into account in considering the *Albugo* species on *Ipomoea hederacea* as a new



variety of *A. evolvuli* for which the name *A. evolvuli* var. *mysorensis* is proposed.

Cytological studies of gametogenesis revealed close resemblance to *A. evolvuli* described by Thirumalachar, *et al.*<sup>1</sup> During first simultaneous division of oogonium and antheridium the dividing nuclei did not show any stage of zonation but were distributed uniformly (Fig. 2). The mature oogonium was uninucleate, and fertilization took place by the migration of a single male nucleus from the antheridium. The mature oospore showed 12 to 16 free nuclei (Fig. 3). The remnants of the nuclei of the periplasm and the antheridium remained persistent even in mature oospore.

Grateful thanks are due to Dr. L. N. Rao and Dr. M. J. Thirumalachar for the help in preparing this note.

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K. M. SAFEEULLA.

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#### PATHOGENICITY OF *PUCCINIA* *KUEHNII* (KRUEG)

##### BUTLER ON SUGARCANE IN BIHAR

A SERIOUS outbreak of rust was reported for the first time in this country from Canal Tracts of Bombay State on Co. 475 by Patel, *et al.*<sup>1</sup> Since *P. Kuehnii* (Krueg) Butler is commonly met with in this State on *Erianthus arundinaceus* and has recently been noted on *E. munja* also by Sharma,<sup>2</sup> its pathogenicity on some of the recommended sugarcane varieties of Bihar, viz., Co. 453, Co. 513, B.O. 10\* and B.O. 11 was tested to see whether these wild species of *Saccharum* could serve as a source of infection. Inoculations were, therefore, made during last winter and it was found that the rust was unable to successfully infect these varieties though *E. arundinaceus* used as control developed rust pustules in due course. Also exposure of these varieties to constant shower of inoculum in natural conditions, by keeping them beneath heavily infected clumps of *E. arundinaceus* for about 4-5 months did not bring about any infection. It, therefore, appears that sugarcane varieties grown on large scale in Bihar are immune to the rust occurring on *E. arundinaceus* at Pusa.

Co. 475 was also included in these experiments because of its great susceptibility to rust in Canal Tracts of Bombay State to see its re-

action to *P. Kuehnii* found in this State. As was the case with the varieties mentioned above, this also was found to be immune to the rust.

Central Sugarcane Res. Stn., S. L. SHARMA.  
Pusa, Bihar,  
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\* B.O. which stands for Bihar and Orissa is a series of sugarcane varieties bred and selected at the Central Sugarcane Research Station Pusa, Bihar.

#### EMBRYOLOGY OF THE *PASSI-* *FLORACEAE*

COOK<sup>1</sup> has recorded some embryological features in *Passiflora adenophylla*. The present note deals with an account of the embryology of *Passiflora Leschenaultii* DC., and *P. foetida* Linn.

The wall of the anther consists of four layers of cells external to the tapetum. The tapetal nuclei are plurinucleate at a later stage. Secondary fusions in the tapetal nuclei are also noticed. The endothecium develops fibrillar thickenings; a stomium is organized. The pollen grain at the time of shedding is two-nucleate and has six germ pores (Fig. 1). The exine shows reticulate thickenings. Occasionally, the pollen grains degenerate in the anther locule.

Indefinite number of bitegmatic crassinucellate anatropous ovules are borne on three parietal placentae of the unilocular superior ovary. The micropyle is organized by both the integuments. The archesporium is hypodermal. A massive parietal tissue is present. Megasporogenesis proceeds normally and the development of the embryo sac follows the Polygonum type. In the elongated embryo sac the synergids are hooked and sometimes show a filiform apparatus. The antipodals degenerate early. Double fertilization is observed. The pollen tube is aggressive in its entry often distuffing the egg apparatus and thereby causing degeneration of embryo sac. Cases are also observed where the pollen tube remains in a coiled state in the micropylar end of the embryo sac and even persists in the developing seed.

Endosperm is nuclear and the nuclei usually aggregate at the chalaza in dense cytoplasm (Fig. 2). Later the endosperm becomes cellular. At the same time the endosperm tissue presents an irregular outline due to the development of indentations from the seed coat. The cells of

the endosperm at the chalazal end become multinucleate due to secondary nuclear divisions or uninucleate as a result of secondary fusions. Sometimes, the endosperm disappears even at the free nuclear stage itself due to very vigorous development of a number of indentations.

The three-layered inner and outer integuments contribute towards the formation of seed coat. The middle layers of both the integuments are completely crushed during development of the seed. The innermost layer of the inner integument gets deeply stained and the outer-

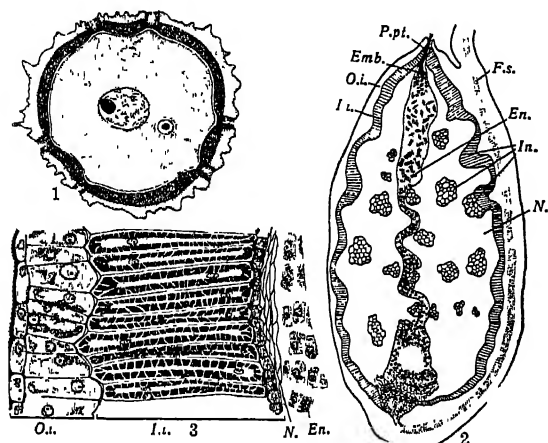


FIG. 1. Mature pollen grain,  $\times 600$ . FIG. 2. L. S. young seed,  $\times 16$ . FIG. 3. Portion of seed coat  $\times 180$  (*In*, endosperm; *Emb.*, embryo; *F.s.*, funicular strand; *I. i.*, inner integument; *In*, indentations; *Nu.*, nucellus, *O. i.*, outer integument; *P. pt.*, persistent pollen tube).

most layer becomes prominently elongated and lignified (Fig. 3). The epidermal layer of the outer integument develops a thickened echinulate external wall. The innermost layer of outer integument remains unstretched (Fig. 3); but at the region of indentations it is pushed inwards (*In*. in Fig. 2).

The pitted seeds are arillate and the aril develops very vigorously during post-fertilization stages.

My sincere thanks are due to Prof. L. N. Rao and Dr. K. Subramanyam for guidance and valuable suggestions.

Dept. of Botany,  
Central College,  
Bangalore,  
September 9, 1952.

M. V. S. RAJU.

## APPLICATION OF RUSSEL EFFECT TO THE IDENTIFICATION OF THE HEARTWOOD AND SAPWOOD OF SAL

THE identification of the true heartwood and sapwood of Sal (*Shorea robusta*) has presented considerable difficulties to the wood technologist. As a rule the dark-coloured central portion of a tree or log is called heartwood and the outer portion is called sapwood. In the case of Sal, however, both the heartwood and the sapwood turn to a brownish black colour on exposure. Colour, which is generally the main criterion of distinguishing between the sapwood and heartwood of timbers, can hardly be safely relied upon in the case of Sal.

Sal is a wood which is extensively used in India for the construction of railway sleepers. However, it is only the heartwood that can be used for this purpose as the sapwood is highly perishable and does not last long in contact with the soil. A proper identification of the heartwood and sapwood of Sal is therefore of great industrial importance.

In a paper in the *Indian Forest Bulletin*, Chowdhury<sup>1</sup> outlines a method for the proper identification of the heartwood and sapwood of Sal. His method consists in a microscopic examination of the anatomical structure of the specimen with a view to finding out the presence or absence in them of tyloses. The possibility of the application of Russel effect to the solution of the problem suggested itself to the author and as a consequence the present investigation was undertaken.

The wood specimens for this experiment were obtained from the Forest Research Institute, Dehra Dun. The author's thanks are due to the Wood Technologist of the Institute for so kindly donating them.

The specimens were cut and shaped to the form of rectangular blocks ( $1\frac{3}{4}'' \times 1'' \times \frac{1}{2}''$ ) and their broad faces were rendered smooth by careful planing.

The heartwood and sapwood specimens were then placed side by side on the sensitised surface of a photographic plate (Ilford Special Rapid). An exposure of 24 hours was given following the experimental procedure adopted previously.<sup>2</sup> On processing the plate in the usual manner the Russel images recorded by the two woods were obtained. A visual examination of the plate revealed that the image impressed by the heartwood was clearly denser than that of the sapwood. Actual densitometer measurements showed that the density of one was nearly double that of the other.

A photograph (positive print) of the pictures

1. Cook, M. T., *Bull. Torrey Bot. Club*, 1909, 36, 373-74.

recorded by the two woods is reproduced below, which clearly reveals the pronounced difference between the densities of the images impressed by the two woods.



The experiment was repeated for exposures of 48 hours and 72 hours and for different samples. The results obtained were nearly identical. Details of the experiment together with data obtained will be published elsewhere.

It is thus seen that a study of the Russel effect in the heartwood and sapwood of *Shorea robusta* furnishes a useful method of distinguishing between the two woods. The method has the advantage that it is extremely simple and requires no elaborate or costly equipment.

The author is grateful to the authorities of the Pachaiyappa's College, for the facilities afforded for the conduct of this investigation.

Dept. of Physics, V. P. NARAYANAN NAMBIYAR.  
Pachaiyappa's College,  
Chetput, Madras,  
June 15, 1952.

1. Chowdhury, K. A., *Indian Forest Bulletin*, 1942, 115. 2. Narayanan Nambiyar, V. P., *Curr. Sci.*, 1949, 18, 284-86., *Ibid.*, 1951, 20, 190-91.

#### ABNORMAL MICROSPOROCYTES IN *CAESALPINIA PULCHERRIMA* SW.

WHILE demonstrating the PMC division in *C. pulcherrima* to students last August, some abnormal microsporocytes were noticed as reported below. Subsequent smears of anthers from a number of plants growing in the area showed that normal tetrad formation is the usual rule. Only in one plant both normal and abnormal microsporocytes were seen, but when the same plant was examined after about a month only normal tetrads were observed. The abnormalities consist in the microsporocytes forming 8, 6 and 3 microspores in addition to a few normal tetrads (Figs. 1-4); the majority,

however, possess 6-8 microspores. During the abnormal division there is high pollen sterility, only 8% being fertile in a count of about 500 grains from different flowers. Similar abnormal microspore formation has also been observed in *Cuscuta reflexa*<sup>1</sup> and a number of other plants.

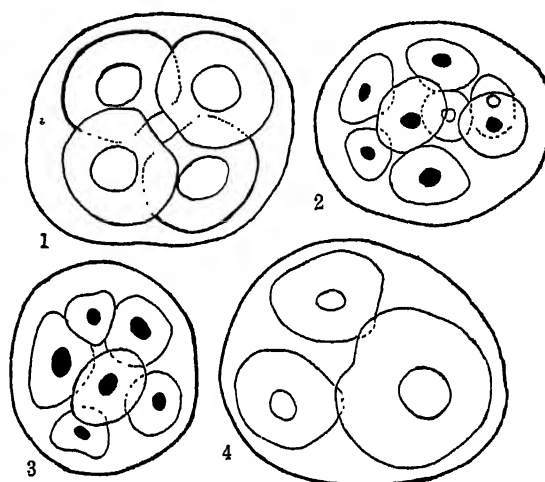


FIG. 1. Normal tetrad; 2-4. Abnormal microsporocytes ( $\times 190$ ).

Darlington<sup>2</sup> has discussed several cases of abnormality in microspore formation and attributed the phenomenon to the variable "behaviour of the dividing cells in which the normal relationships of the spindles to the chromosomes have been upset by failure of pairing. No doubt this is due to a susceptibility to environmental changes". In this case the abnormality was temporary and the normal condition was subsequently restored in the same plant. This abnormality also appears to be created by some sudden change in the internal condition of the plant due to fluctuation in temperature or other environmental factors causing disturbance in the normal meiotic behaviour. The formation of microsporocytes with 8 spores may also be due to further division of the microspores within a tetrad.

Thanks are due to Prof. P. Maheshwari for facilities and encouragement.

Dept. of Botany,  
Delhi University,  
July 22, 1952.

S. K. MUKHERJEE.

1. Johri, B. M. and Tiagi, B., Floral morphology and seed formation in *Cuscuta reflexa* Roxb., *Phytomorphology*, 2, No. 2 (in the press). 2. Darlington, C. D., *Recent Advances in Cytology*, 1937, 399-419.

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## REVIEWS

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**Plane and Spherical Trigonometry.** By L. M. Kells, W. F. Kern and J. R. Bland. Third Edition. (McGraw-Hill Book Co.), 1951. Pp. 290.

The book is a revised edition of a text-book primarily intended for use in military and naval schools, and in technological institutes. The scope of the subject-matter is adjusted to suit the needs of such institutions, and hence falls slightly short of our usual Intermediate syllabuses. The treatment is lucid and precise. A good number of problems of topical interest to technological students are given and are illustrated by pictures or drawings. These pictures and drawings will certainly stimulate interest in the subject to those who may be apathetic towards mathematics.

There are three chapters on spherical trigonometry, including definitions, solutions of spherical triangles and a brief account of their application to the determination of co-ordinates of celestial bodies.

In Appendix I, an angular unit called the *mil* is introduced, which is equal to  $1/6400$  of four right angles. This unit has been found convenient in certain military measurements. This was adopted by the Infantry during World War I, and has now become general in military science. The book ends with two Tables—one of four-figure logarithms, and the other of four-figure logarithms of the trigonometric functions.

Our students of the Intermediate classes will doubtless find the book stimulating and useful.

C. N. S.

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**The River Mathematics.** By A. Hooper. (Oliver & Boyd Ltd., Edinburgh and London), 1951. Pp. 370. Price 18 sh. 6 d. net.

Mathematics is the river "on which now sail the proud ships of Science, Engineering and Aeronautics", "whose ventures into the unknown offer mankind the possibility of a New World of freedom from want and consequently of freedom from fear. Except for the River Mathematics, these ships could never have been launched; only its never-failing flood keeps them afloat". The river split into two distinct branches, called "Geometry" and "Number Reckoning", millenniums before 2,000 B.C., which were shut off from each other until modern times. Two long tributaries by name "Astronomical Measurement of Angles and Chords, etc." and "Abstract

Science of Numbers" on opposite sides of the main river, eventually flowed into it and helped to break down the barrier that for many centuries had kept apart the branches of the main river.

Opening the book with these poetic ideas, the author gives a very neat and lucid account of the development and fundamental ideas of arithmetic, algebra (including logarithms), graphs and co-ordinate geometry, geometry, trigonometry and the calculus. The names of some of the chapters suggest not only the scope of the subject-matter, but also continue the poetic touch in the background of the whole book: Number-Symbols, Bits and Pieces (i.e., fractions), Indicating direction on the Number-Scale, Mathematical Pictures (i.e., graphs), "Earth-Measurement", position of a point on a surface, Building up Formulæ, the Rate of Growth of a Function—the Calculus.

As one of the finest books that can be recommended to the general student who seeks after a clear picture of the fundamental processes of mathematics, the book must find a place on the book-shelf of every general library. To the specialist in mathematics too, the book will furnish a delightful recreation for easy-chair reading or for a railway journey. The teacher of elementary mathematics will certainly profit by the book which should inspire him to make his presentation of the subject lucid and appealing to the common man. The get-up of the book is excellent.

C. N. S.

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**Molecular Microwave Spectra Tables.** By Paul Kisliuk and Charles H. Townes. (National Bureau of Standards, Circular 518), Pp. 127. Price 65 cents. (Copies can be had from Government Printing Office, Washington 25, D.C.)

Although microwave spectroscopy is a subject of recent origin, it has grown considerably during the short period of its existence. The present volume summarising the results obtained so far in tabular form is therefore quite welcome. It is bound to stimulate further research in this field.

The Tables constitute a modernisation and revision of those published in the *Journal of Research of the National Bureau of Standards*. (1950, 44, 611) and include materials published

upto November 15, 1950, and also much unpublished information.

The introduction provides an explanation of the Tables and also a short discussion of microwave spectra and important formulæ. In the Tables are given the frequencies, assignment of quantum numbers, and intensities of about 1,800 microwave absorption lines. They also include the best available values of other pertinent molecular data, such as rotational constants, dipole moments, quadrupole coupling constants, and rotation vibration interaction constants. In addition to listing the frequencies once for each molecule, the circular lists then again in consecutive ascending order of frequency. Only molecular lines of frequency greater than 1,000 megacycles are included. This excludes resonances found by molecular beam techniques rather than the usual microwave absorption measurements, also those of atomic hydrogen and caesium that fall in the microwave region. Microwave absorption in paramagnetic gases due to transitions between Zeeman components is not included.

References are given for all the data contained in the Tables. For easy calculation of quadrupole hyperfine structure, a tabulation of Casimir's function is included. An alphabetical list of authors, and lists of molecules by name and by chemical symbol have been included as Appendices.

R. S. K.

**Corrosion Testing Procedures.** By F. A. Champion. (Chapman & Hall Ltd., London), 1952. 8 vo. Pp. xi + 369, Illustrated.

Considering that corrosion testing procedures are so variable and conditioned so largely by the environment, Dr. Champion deserves to be congratulated on producing this excellent treatise on the subject.

The author has successively dealt with in critical detail the factors governing the selection of test specimens, the several kinds of corrosion media and the various tests that can be conducted both in the laboratory as well as outside. The later chapters deal with the assessment of effects of corrosive attack on the specimens and on the presentation and interpretation of results. The treatment is throughout clear and full although it may appear that the final chapter on the interpretation of results could have been somewhat amplified.

The diagrams of the various apparatus are very clear and helpful. The author has obviously written the book so that the research worker can construct his own apparatus. The exhaustive list of references at each stage will

be immensely useful to the research worker. The volume should find a place in every library.  
E. G. R.

**Chemistry of Carbon Compounds, Vol. I, Part B, Aliphatic Compounds.** Edited by E. H. Rodd. (Elsevier Publishing Co., London and New York), 1952. Pp. 779-1462. Price £ 7.

Part A of this volume dealing with 'General Introduction and Aliphatic Compounds' has already been reviewed in this Journal. Part B completes the systematic treatment of aliphatic compounds. There are eleven chapters (Ch. XII to XXIII) covering about 700 pages. Following the prevalent practice, carbohydrates are also included in this part though they exist largely in a cyclic form. This class of compounds and their derivatives are treated fully in detail and plenty of references are given. A brief account of the group of ascorbic acids forms part of this treatment. The last two chapters deal with proteins and enzymes, and contain up-to-date information on these highly complex and biologically important groups of substances.

Along with the present volume is supplied the errata for Vol. I, Part A. There seems to be need for a similar list for Part B also. For example, on p. 973 the data given about norcaperatic acid are wrong; for it is not a succinic acid derivative, but is a derivative of citric acid. Roccellic acid is not found under succinic acid derivatives and this is a serious omission of a naturally occurring compound.

The special features mentioned in connection with Part A are kept up such as evenness of treatment and references to original sources. Probably more references could be given. An important sugar like L-sorbose does not get the literature reference for its preparation from sorbitol by bacterial oxidation (p. 1259). In books of this nature with limitations of space, it is naturally difficult to pick and choose references very correctly. There is no doubt that the present volume provides a valuable reference book on the portions dealt with.

T. R. S.

**Isotopes in Biochemistry—Ciba Foundation Conference.** (J. A. Churchill Ltd., London), 1951. Pp. xv + 288. Price 27 sh. 6d. net.

Under the auspices of the Ciba Foundation, scientists actively interested in the biological application of isotopes from all over Europe and America, met to discuss the present status of the subject, pool their experiences and smoothen out their technical difficulties. This conference, the tenth of a series sponsored by the Founda-



tion, was distinguished by the fact that the membership was strictly limited to active workers, thereby securing a high level of efficiency of its proceedings. These are presented in the volume under review in six parts: (1) Steroids, (2) Hæmoglobin and metabolic derivatives, (3) Use of tracers in the study of biological effects of radiation, (4) Nucleic acids, (5) Proteins and amino acids, and (6) Carbohydrate and fatty acid metabolism.

Sir Charles Harington in his foreword to the volume has cautioned about the difficulties, complexities and limitations inherent to the tackling of biochemical problems with the aid of isotopes as tracers. In the words of Sir Charles, "All these problems require powers of biochemical interpretation; many of them demand also new work in organic chemistry, both for the synthesis of the specifically labelled precursors whose metabolic fate it is desired to study, and for the stepwise degradation of the biosynthetic product, so that the process of its formation can be analysed. Again new methods of isolation of intermediary metabolites may have to be devised. Thus the full development of the isotope technique in the field can only be achieved with the aid of concurrent advances in the more conventional chemical and biochemical methods."

A study of the volume will show how the views of Sir Charles have been supported by the proceedings of the conference which 'are not only of the greatest intrinsic interest, in so far as they indicate the potentialities of isotope research in biochemistry, but serve as an inspiration for the further cultivation of this productive field of work.'

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**The Enzymes.** (*Chemistry and Mechanism of Action*), Vol. II, Part I. Edited by James B. Sumner and Karl Myrback. (Academic Press Inc., Publishers, New York), 1951. Pp. ix + 790. Price \$ 14.80.

This volume, the third in this monumental series, contains 21 topics contributed some of the top-ranking workers in the field.

A brilliant exposition of the theory of oxidation-reduction by L. Michaelis constitutes the first posthumously published article in the volume. Nathan O. Kaplan discusses the thermodynamics and mechanism of the energy-rich phosphate bond which is of fundamental importance in the promotion and regulation of metabolic reactions. The subject of Transphosphorylating Enzymes of Fermentation, is reviewed by Sidney P. Colowick. The fourth contribution by H. M. Kalcker relates to De-phosphorylation of Adenosine Polyphosphates,

Aldolase which has been crystallised from different sources and Isomerase discovered by Meyerhof and Kiessling, have both been described by Meyerhof.

The subject of keto acid decarboxylases has been reviewed by Birgit Vennesland while that of amino acid decarboxylases is treated by Otto Schales. A two-page article on desulfinate is contributed by C. Fromageot who first observed this enzyme in rabbit liver.

The important subject of codehydrogenases and apoenzymes has been comprehensively reviewed by F. Schlenk whose own substantial contribution to this field are well known. The tenth article in this volume on succinic dehydrogenase has also been contributed by Schlenk. Hydrogenase and hydrogenlyase are treated by W. W. Umbreit in the following article.

Hugo Theorell has discussed the topic of Flavine containing enzymes. This is followed by a bunch of three articles on the iron-containing enzymes: on cytochrome by K. G. Paul, on catalases and peroxidases by H. Theorell and on the enzyme substrate compounds by Britton Chance. Copper oxidases which comprise tyrosinase, laccase, other phenolases and ascorbic acid oxidase, have been reviewed by C. R. Dawson and W. B. Tarpley. This is followed by articles on oxidation of amino acids by H. A. Krebs, on Oxidation of Amines by E. A. Zeller and on Lipoxidase by R. T. Holman and Sune Bergström. A highly specialised type of the enzyme system associated with Bioluminescence is described by E. N. Harvey who is the foremost authority on this subject. Oxidation of organic sulphur with special reference to animal metabolism is the subject of a contribution by C. Fromageot. Anaerobic glycolysis, respiration and the closely connected phenomenon of the Pasteur Effect, has been treated by Frank Dickens in an illuminating article. Finally F. F. Nord and his associate Sidney Weiss have contributed a brilliant review on yeast and mold fermentations.

The high standard and brilliance of the contributions has been secured through international collaboration among workers from Denmark, France, England, Sweden and the U.S.A. The Editors of the series deserve to be congratulated on this praiseworthy enterprise.

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**The Genetics of Garden Plants.** By M. B. Crane and W. J. C. Lawrence. (Macmillan & Co., Ltd., London), 1952. Fourth Edition. Pp. xvii + 301. Price 20 sh.

This is the revised and amended edition of the standard book on the genetics of garden

plants. The subject of Heterosis is treated in greater detail in this edition and details of genetics of *Nemesia*, *Dianthus* and *Brassica* have been added. The issuing of a fourth edition establishes the well-deserved popularity of this book.

Since a review of any previous edition has not appeared in this journal, the main features of this book may be mentioned. Both the authors are connected with the John Innes Horticultural Institution and have made valuable contributions to plant genetics and pomology. The book is comprehensive in that it deals with the principles of genetics, genic analysis of selected garden plants and fruits of temperate countries, as well as a consideration of origin of new and improved forms. A chapter on the chemical and genetical basis of flower colour needs mention, as this is an interesting line of genetical research deserving attention of all plant geneticists. The major contributions to this subject have been made from the John Innes Institution and this book gives a very good account of it.

Because of the original treatment of the subject, the book is essential to all botanical libraries. As a text-book, however, the book is too advanced for undergraduates, and further the ornamental and fruit plants genetically analysed are not commonly grown in this country.

C. G.

**A Guide to Filter-Paper and Cellulose Powder Chromatography.** Compiled by J. N. Balston and A. E. Talbot. Edited by T. S. G. Jones. (H. Reeve Angel & Co. Ltd., London, and W. R. Balton Ltd., Maidstone), 1952. Pp. 145. Price 8 sh.

This volume represents an extremely useful and welcome treatise on the methods and applications of paper chromatography, which by virtue of its simplicity, elegance, flexibility and extensive and varied applicability, has been attracting the attention of ever-increasing number of scientific investigators. Methods of cellulose powder chromatography are also included in this volume.

The success of this versatile technique depends among other factors, on the excellence, quality and uniformity of the filter-paper employed. It is a source of great satisfaction that Messrs. W. R. Balton Ltd., the famous manufacturers of Whatman Filter-Papers and Cellulose Powders have sponsored the publication of this treatise. They invite comments and criticisms from workers and it is hoped this co-operation will bring out improvements in the

quality of the paper. The volume is presented in two parts; the first part deals with methods and materials; the second with applications of the technique.

A highly instructive treatment on the methods of using filter-papers, impurities associated with the materials, choice of paper, specifications of different types of filter-papers, are included in the first part. This part should be carefully read by every one who wishes to avoid serious pitfalls in the practice of this simple technique and obtain reliable and reproducible paper chromatograms.

The second part gives an illuminating survey of the applications of the technique and describes under each section the several modifications introduced. This part contains a great wealth of practical information.

We have no doubt that this most opportune publication with its elegant get-up and modest price, will be received with enthusiasm and gratitude by all workers in this field.

#### Books Received

*Five-Membered Heterocyclic Compounds with Nitrogen and Sulphur or Nitrogen, Sulphur and Oxygen (Except Thiazole).* By L. L. Bambas. (Interscience Publishers), 1952. Pp. xi + 403. Price \$14.00.

*Advances in Catalysis*, Vol. 4. Edited by W. G. Frankenburg and V. I. Komaressky and E. K. Rideal. (M/s. Academic Press), 1952. Pp. xi + 457. Price \$9.50.

*Annual Epidemiological and Vital Statistics*, 1947-49, Part I. W.H.O., (Geneva), 1952. Pp. 746. Price \$10.00.

*The Rational and the Super-rational*, Vol. II. By Cassius Jackson Keyser. (M/s Scripta Mathematica), 1952. Pp. viii + 259. Price not given.

*Dairying in India.* By J. N. Warner. (Macmillan & Co.), 1951. Pp. xii + 380. Price not given.

*A Study of Combined Bending and Axial Load in Reinforce Concrete Members.* By Eivind Hognestad, University of Illinois Engineering Experimental Station), 1951. Pp. 128. Price \$1.00.

*What do We Know about Diagonal Tension and Web Reinforcement in Concrete?* By Eivind Hognestad. (University of Illinois Engineering Experimental Station), 1952. Pp. 47. Price \$0.50.

*The Initiation and Growth of Explosions in Liquids and Solids.* By F. P. Bowden and A. D. Yoffe. (Cambridge University Press), 1952. Pp. xii + 104. Price 22 sh, 6 d.

*Punched Cards, Their Applications to Science and Industry.* Edited by Roberts S. Casey and James W. Perry. (Reinhold Publishing Corporation, New York), 1952. Pp. viii + 506. Price \$ 10.00.

*Typical Means.* By K. Chandrasekharan and S. Minakshisundaram. (Oxford University Press, Madras), 1952. Pp. x + 139. Price Rs. 22-8-0.

## SCIENCE NOTES AND NEWS

### Ripening of Mangoes

Shri K. Kirpal Singh and Dr. P. B. Mathur, Division of Storage and Preservation, Central Food Technological Research Institute, Mysore, report as follows:

A study of the work so far conducted on the cold storage of mangoes (e.g., Cheema, G. S., Karmarkar, D. V., and Joshi, B. M., *Ind. Jour. Agric. Sci.* 1950, 20, 259 and Wardlaw, C. W. Low Temperature Research Station, Trinidad, *Memoir No. 7*, 1937) gives the impression that mangoes can be ripened satisfactorily at any temperature ranging from 60° F. to room temperature. An investigation conducted at Mysore has shown that the ripening of mangoes at 67-70° F. has several important advantages over the usual method of ripening at the room temperatures, such as, an increase in the percentage of total soluble solids and a lesser decrease in acidity and a better sugar-acid blend. Recognition of the fact that there is an optimum temperature for mango ripening will not only curtail the wastage incurred otherwise but will also provide better ripened fruits. Details in connection with these experiments will be reported elsewhere. Our thanks are due to Dr. V. Subrahmanyam, Director, for his keen interest in these investigations.

### Damage to Pulses from *Bruchid* Pests

Shri Snehamay Chatterjee, Indian Agricultural Research Institute, New Delhi, writes that as a result of laboratory experiments, it was found that the damage to stored pulses and net loss in weight from *Bruchid* pests is more under lighted condition of storage than under dark condition. The damage was also more in ventilated sets than in air-tight ones in both the lighted and dark conditions. Therefore, in order to have the minimum loss of the grains, pulses may have to be stored in opaque receptacles or in dark condition of storage and the purpose would still be better served if the grains are stored in air-tight containers.

Grateful thanks are due to Dr. E. S. Narayanan for guidance in this work.

### Rain Making with Common Salt

Dr. D. A. Davies, Director, East African Meteorological Department, Nairobi, reports that trials are being made this season, in conjunction with the Overseas Food Corporation, with a mixture of 90 per cent. sea-salt and 10 per cent. calcium chloride, ground to 5-100 micron particle size. Canisters holding 15 g. of this powder are being borne aloft by balloons and dispersed at the base of cumulus clouds by 1½ g. charges of gunpowder exploded by time-fuses.

The scientific hypothesis underlying the experiment is that silver iodide, now the agent most generally used to cause precipitation, is effective only at several degrees below freezing point. In the tropics, however, rain is found sometimes to fall from clouds at temperatures above the freezing point. Dr. Davies hopes that the hygroscopic materials now being tried will produce large water drops which, in their fall, will grow by collision, split and repeat the process in a chain reaction—an idea suggested by F. H. Ludlam. The materials would also be very cheap and plentiful.

### Preservation of Wild Life

A Central Board for Wild Life has been set up in India under the Ministry of Food and Agriculture. It is charged with supervising the maintenance of India's valuable fauna, of which several species, including the Asiatic lion, the one-horned rhinoceros, the tragopan and the cheetah, are in danger of becoming extinct. Other duties of the Central Board are to encourage the creation of reserves and national parks, to advise the authorities on measures necessary for conservation, and to undertake education in the field of nature protection. The President of the Central Board for Wild Life is H. H. the Maharajah of Mysore.

### Study of Penicillin Technology

Dr. G. Sankaran, Officer-in-charge, Indian Penicillin Committee, Bombay and Dr. K. Ganapathi, Assistant Director, Haffkine Institute,

Bombay, have been deputed to Switzerland and U.S.A. for a period of six months for training in penicillin technology on a W.H.O. Fellowship.

#### New Uranium Detector

A new detection device that locates uranium much faster and more accurately than the Geiger counter has been developed by the Atomic Energy Commission of the U.S.A. The probe is said to be accurate almost to an inch measuring the depth of ore strata. It is also much more sensitive to smaller deposits of metal and indicates varying energy impulses, thus identifying elements.

#### Development Fund for India

The Norwegian Parliament has voted £ 500,000 for the Fund and a national campaign is being organised to raise another £ 500,000 by voluntary contributions. The Fund is intended chiefly to give technical and economic assistance to a development area in India, not yet specified. Dr. U. S. Sverdrup, Director of the Norwegian Polar Institute, has been appointed Chairman of the Fund.

#### Quartz Paper as Insulator

A new quartz paper announced by a firm in Ohio is said to resist temperatures upto 3,000° F., which is more than the temperature limit of asbestos. It has also been found to be an effective insulator for high frequency circuits.

#### Harvests from the Desert

The Aral Experimental Station established 19 years ago in the U.S.S.R. has developed effective measures of cultivating farm crops on sandy soil in the semi-desert regions, thus exploding the current view regarding their lack of fertility. These new methods are based on the careful conservation of winter moisture accumulated in the soil; conservancy fallowing of the soil by planting sorghum, which ensures the accumulation of a winter snow covering of up to two or three feet; and planting crops in wide rows with a reduced quantity of seed to the acre. The station has also developed advanced methods of irrigation for this zone, based on the travelpolye system of crop rotation. These methods make for higher fertility of the soil, prevent resalination and ensure high yields.

#### UNESCO Subventions for Scientific Conferences

A Report published by the UNESCO indicates the large extent to which various international non-governmental organisations ranging from the International Union of Pure and Applied Physics to the Institute of Oceanography and the International Union for the Protection of Nature have received financial support from the UNESCO both in regard to their regular activities and in particular for convening conferences and holding symposia. Notable among these activities was the conference on Nuclear Physics held in Copenhagen in July, 1951.

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### IMPORTANT NOTICE

In view of the transfer of the Editor to Madras, it is requested that all articles, letters, reviews, books for review, exchange journals, corrected proofs and other items intended for publication in CURRENT SCIENCE may kindly be addressed to :

Professor G. N. Ramachandran,  
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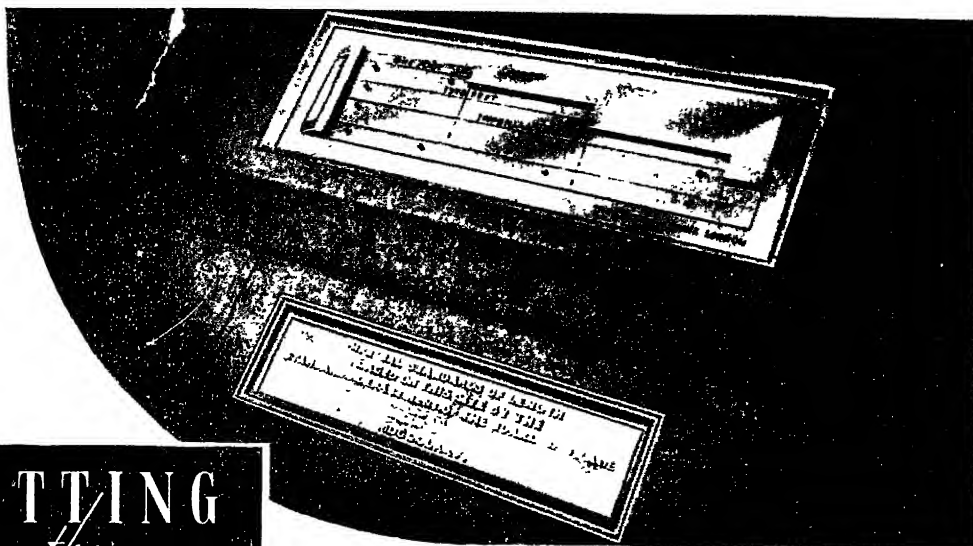
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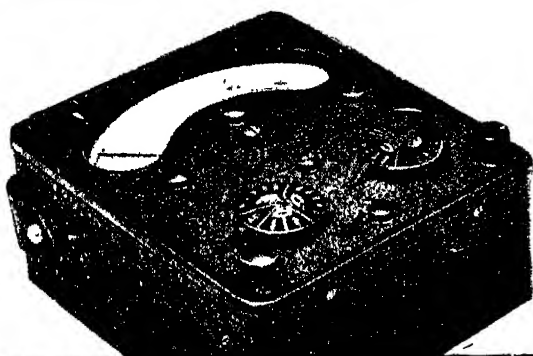
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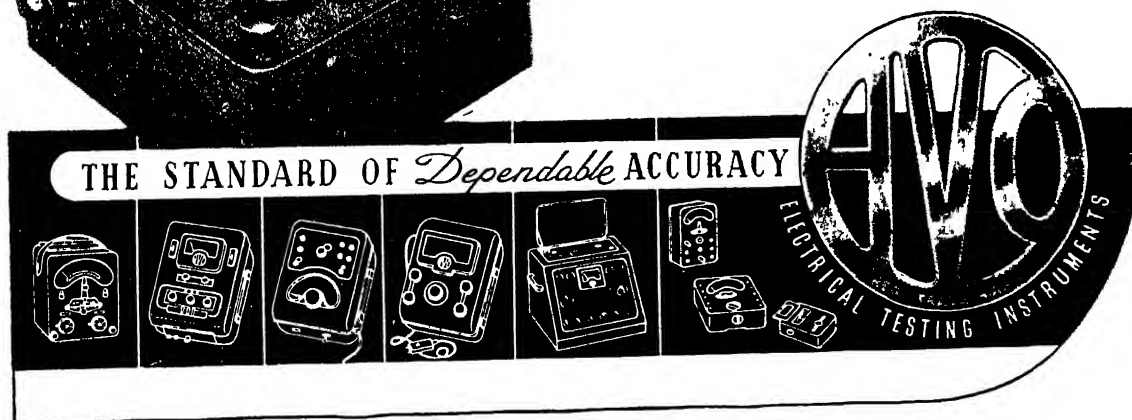
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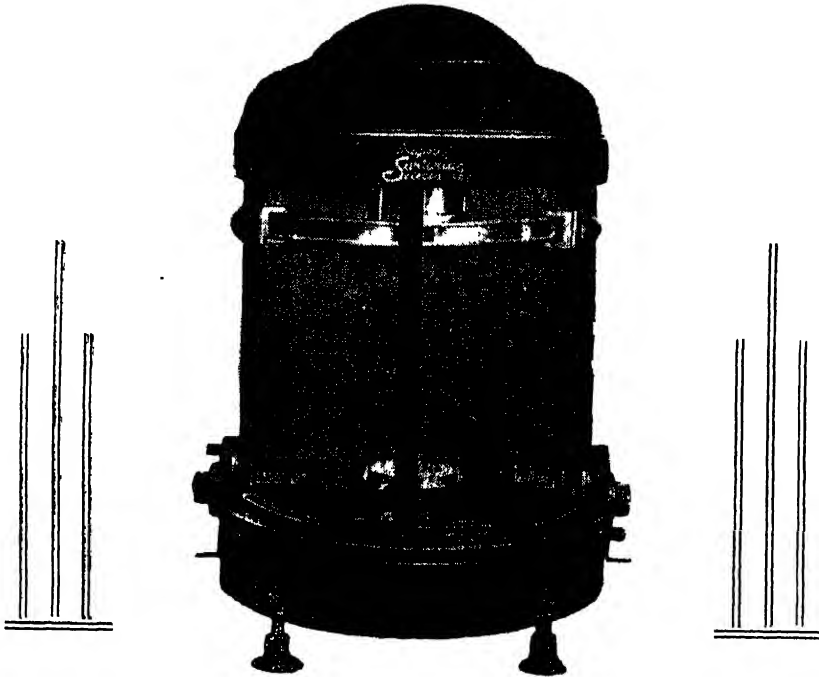
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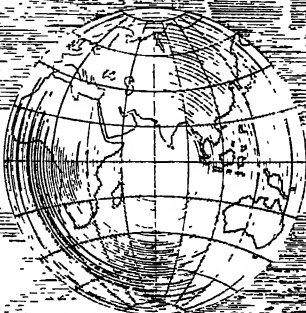
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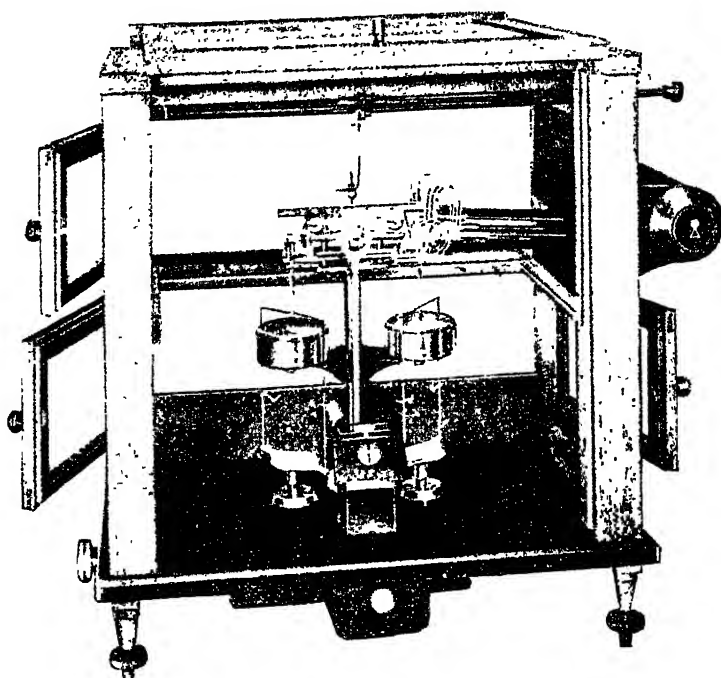
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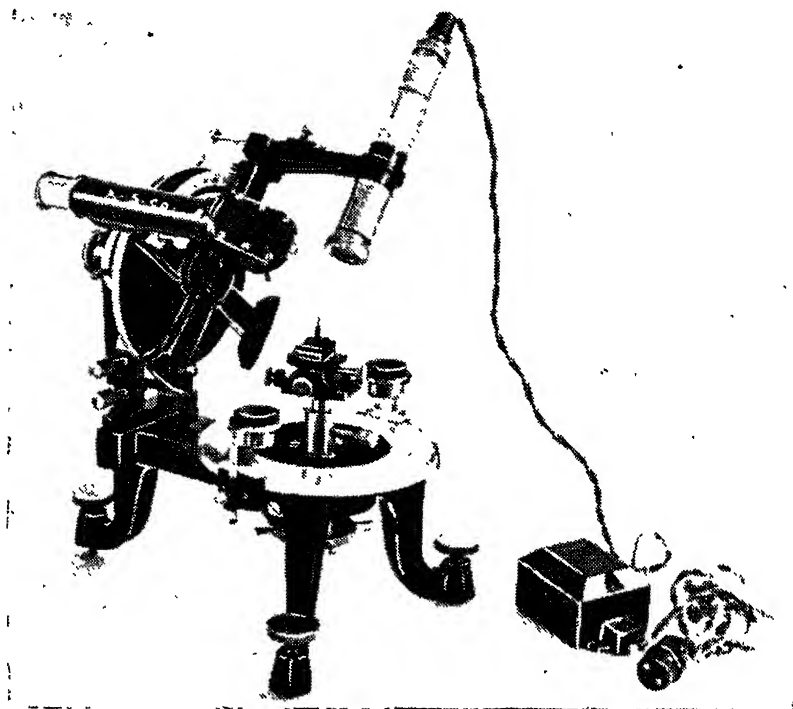
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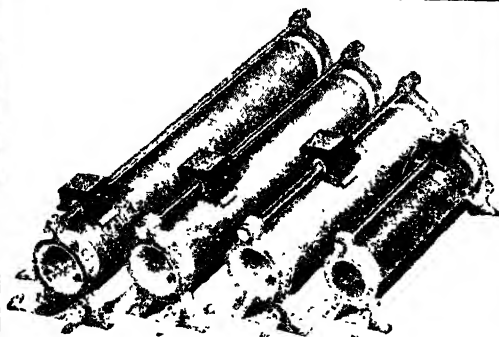
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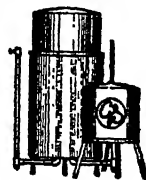


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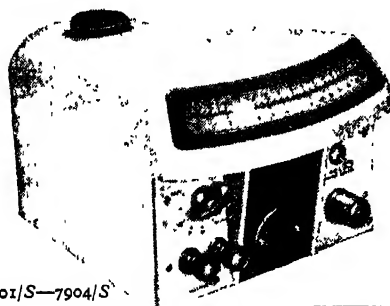
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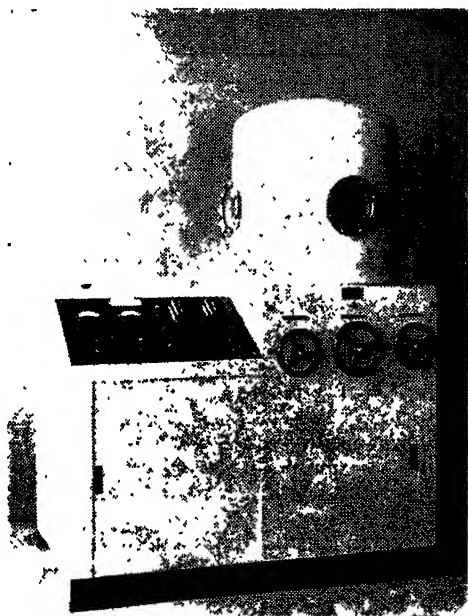
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## SCIENCE IN GENERAL EDUCATION\*

TO appreciate the place which scientific studies occupy in education, it would be well to consider two separate kinds of education: on the one hand, general education, and on the other, specialized or professional training. In the latter, science crops up in a number of ways according to the more or less technical character of the career chosen, whereas in general education its place is always the same.

In reality, then, there are two problems and the role of education is not identical at each stage. It is in the course of so-called higher or professional education that great differences appear in the study of the sciences. The need to acquire the vast assortment of technical and theoretical knowledge required for all the professions nowadays unhappily obliges most young people—and I do not know if this is inevitable or not—to bypass all other subjects except those essential for their particular training.

It is upon primary and above all upon secondary education that the onus falls of providing

all young people with a grounding in science, not only in order to give them access to a technical or scientific career, but also to supply those destined for non-scientific activities with the minimum information necessary for life in modern society. It will save them from being non-plussed by the first problem with which their work itself will present them in a domain inevitably linked more or less closely with science. For future specialists, therefore, a judicious preparation at the secondary stage is extremely useful; but for those who do not intend to study science after matriculation, some scientific education before they reach that parting of the ways would seem to be really indispensable. It is thus especially for the benefit of the second group that we should endeavour to give all school children, before matriculation and while there is still time, a general outline of science, so as to awaken their interest in scientific achievements and thoroughly to acquaint their minds with scientific method. At this common stage of general education, it is much more important to develop the ability to learn than to accumulate items of knowledge.

If we are to succeed in this task, we must firmly reject every proposal for dividing science

\* Abstract of the Address by Dr. Jaime Torres Bodet, Director-General of UNESCO, at the Conference on Public Education held in Geneva from 7th to 16th July.

subjects between secondary and higher education. There is no reason to tire and discourage students by obliging them to follow all the historical and technical by-paths that the pioneers had perforce to tread. Science as taught must be *living science*. Great highways have been marked out, and we must make use of these without hesitation.

The ideal would be to ensure that young people leave school or secondary school, or college, feeling that they have made a real contact, however brief, with the whole world of science; that they have enjoyed this contact, and that they are ready to renew it, without apprehension, whenever their profession or simply the course of events makes it necessary. By ceasing to be a mystery, science will not lose any of its prestige. It will gain in human

value and without it, there will no longer be a general culture.

This project to make science a part of general culture in no way offends humanism in the strict sense. The traditional cultural values, if they are to hold their own against the imperialistic tendencies of technology, must be receptive to scientific knowledge, from which technology springs. They will not save themselves, nor preserve their influence, by isolation from research and discoveries which characterize modern thought. I have enough faith in the cultural values to know that they have nothing to fear from a broad contact with the sciences. For science has not only affected the material side of civilization but has also been a creative force in its own right.

### RADIATION AND MACROMOLECULES

**A**N International Symposium on the above subject was held in Strasbourg, France, from June 9 to June 12, 1952. The following points discussed during the session deserve special mention:

(a) The light-scattering method is based on absolute measurements of the scattered intensity by certain standard materials; they can be solutions of ordinary organic molecules of known constitution, selected polymeric materials of known molecular weight and molecular weight distribution or colloidal particles of great homogeneity and exactly known size. A thorough discussion of the relative merits of the different calibration procedures seems to indicate that well-defined organic molecules such as hexachlorobenzene in benzene or toluene offer a very good opportunity for reliable calibration.

(b) A thorough discussion of the best methods to purify polymer solutions and prepare them for precise light-scattering experiments led to the conclusion that each individual system polymer-solvent requires special study and discussion. In general it appears that a combination of filtration and centrifugation gives the best results. Special precautions were recommended to avoid contamination of the solutions during the filling of the cell.

(c) An animated discussion developed on the light-scattering from poly-electrolyte solutions and on the configuration of such molecules at different concentrations and at different pH values. The Alfrey-Morawetz solution of the Poisson-Boltzmann equation for rod-shaped particles in cylinder co-ordinates was presented and its consequences for the distribution of the mobile counter ions were discussed.

(d) New results on the optical analysis of soap solutions and of colloidal emulsions were presented; the size and shape of the soap micelles were determined for various soap concentrations, temperatures, pH values and various amounts of added neutral salts.

(e) Two new precision light-scattering instruments were described and numerical data obtained with them were presented; a new and very sensitive differential refractometer was described and its application was demonstrated.

(f) Polymethyl- and polyethyl-silicones ranging from very low (300) to very high (1,000,000) molecular weights were indicated by a combination of the osmotic, light-scattering and viscosity methods. The results together with the mechanical properties of these specimens indicate that polysilicones of this type consist not only of linear chain molecules but also contain interlaced rings of considerable size which cannot be separated from the linear components and are responsible for the unsatisfactory mechanical properties.

(g) The theory of small angle X-ray scattering was thoroughly discussed for the two extreme cases: (a) very dilute solutions of rod-like particles with cylindrical cross-section; and (b) closely packed systems of spheres and rigid rods.

(h) The intermicellar and intramicellar swelling of various types of cellulose with water was studied with X-rays and a significant difference in the behaviour of cellulose from cotton and various wood pulps was discovered.

The contributions will be published in one or two special issues of the *Journal of Polymer Science* late in 1952 or early in 1953.

## NOBEL AWARD FOR PHYSICS, 1952

THE NOBEL PRIZE for Physics this year has been awarded jointly to Professor Felix Bloch of the University of Stanford and to Professor E. M. Purcell of the Harvard University, for their discovery of nuclear magnetic induction and nuclear magnetic resonance absorption respectively. These two independent, but complementary investigations have resulted in the establishment of the new field of research known as "nuclear magnetic resonance".

The discovery of this phenomenon of nuclear magnetic resonance ranks supreme among the post-war discoveries in physics. The wealth of information yielded by such studies during the six years since its discovery has been enormous and about 400 papers have appeared on the subject from all over the world. The discovery set a new standard of accuracy in the measurement of nuclear magnetic moments and other related nuclear constants. The basic principles of the phenomenon are extremely simple and they had been sought for by earlier workers, but without success. But it was the elegant and essentially simple electronic techniques used by Bloch and Purcell which enabled them to detect the effect. In fact, the electronic techniques developed from investigations of nuclear

magnetic resonance have been a source of inspiration to workers in other fields of study as well.

Prof. F. Bloch, who is now 47, had his early training in various Continental schools of research and has been Professor of Physics at the University of Stanford, California, since 1937. His important original contributions to physics include studies in the electron theory of metals, quantum electrodynamics, magnetic moments of neutrons and lastly discovery of nuclear induction, which forms the basis for the award of the Nobel Prize. Prof. Bloch's paper on Nuclear Induction is a model of scientific exposition and every serious student of science will profit from a study of it.

Professor Edward Mills Purcell, born in 1912, studied both in America and Germany. His early work was on the magnetic cooling of substances. During the last war he made many important contributions to the development of radar. He is now Professor of Physics at the Harvard University. His discovery of nuclear magnetic resonance absorption and its application to the study of crystals has opened up a field of study which is likely to bear fruit for a long time to come.

G. SURYAN.

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## NOBEL AWARD FOR CHEMISTRY, 1952

DRS. A. J. P. MARTIN AND R. L. M. SYNGE who share the Nobel Prize for Chemistry in 1952 represent British achievements in chromatography, which have earned the admiration of the scientific world, and have stimulated extensive researches on the application of this technique in all branches of chemistry. The announcement of the award is a fitting recognition of a series of investigations carried out by them jointly on partition chromatography, a new technique evolved by them, its application to the study of protein constituents and the introduction of a new micro-analytical procedure for the isolation, identification and determination of amino acids and peptides in protein hydrolysates.

Dr. Martin and Dr. Synge belong to the younger school of British chemists. For some time Dr. Martin worked in the Dunn Biochemical and Nutritional Laboratories, Cambridge, as Grocer's research scholar and later joined the Wool Industries Research Association, Leeds, as a biochemist in 1938. He is now at the National Institute for Medical Research, London. It was at the laboratories of the Wool Industries Research Association that he, in collaboration

with Dr. Synge, first developed partition chromatography. The preliminary stages of this work was carried out by Dr. Synge in the Dunn Biochemical Laboratory, Cambridge. Dr. Synge worked for some time in the Lister Institute, London, and later in the laboratories of the Wool Industries Research Association. He is now at the Rowett Research Institute, Aberdeenshire.

An entirely new principle was introduced into chromatography by Martin and Synge in 1941 and termed "partition chromatography" in order to distinguish it from the classical adsorption chromatography invented by the Russian botanist, Tswett, in 1906. The separation of substances is achieved by their differences in partition coefficients between aqueous and non-aqueous phases of the components of a mixture. They constructed a complicated multi-plate counter current liquid-liquid extraction machine and used it for the analysis of amino-acids. Later, they devised an ingenious method to hold one of the phases (water) by using a column packed with an inert support (e.g., silica gell) and to allow the immiscible solvent to pass through the water containing

silica gel. They used this new technique to effect a separation of the various acetyl amino acids. They successfully applied these techniques to the study of the amino acid composition of proteins like gelatin and polypeptide bactericidal substances, gramicidine and tyrocidine.

In 1944, considering the limitations of the above technique for the separation of free amino acids, Dr. Martin in collaboration with Dr. Consden and Dr. A. H. Gordon developed a very ingenious modification of partition chromatography, which has found enormous application since its introduction and has become the most valuable of all chromatographic techniques. For this technique, the silica gel column is replaced by filter-paper as the inert support. The great popularity of this new technique, known as paper-partition chromatography,

as an analytical tool is a tribute to the originality and ingenuity of Dr. Martin and it has led to one of the most remarkable advances on record in analytical technique.

There is an intimate connection between the researches of Dr. Martin and Dr. Syngé. On the one hand, the earlier work of Dr. Syngé on the partition coefficients of acetyl derivatives of amino acids formed the basis of the scheme of separation of amino acids by him, in close collaboration with Dr. Martin. On the other hand, it is the work of Dr. Martin who working in Dunn Nutritional Laboratory, Cambridge, constructed the counter current extraction machine for vitamin purification, which brought the two chemists together to evolve new techniques in partition chromatography.

K. V. GTRI.

### ELECTRONIC STERILISATION OF PHARMACEUTICAL PRODUCTS

**T**HE possibility of using high velocity electrons for killing bacteria and other micro-organisms on a commercial scale has been investigated in the United States of America for several years, particularly regarding potential applications in the food and pharmaceutical industries. More recent developments have been concerned with the use of the radiations from radio-active atomic fission products, the waste products from atomic energy projects. The main advantage of the process is that sterilisation of a wide variety of products is possible, within severe practical limits, without the extensive damage associated with heat or chemical sterilisation. Small amounts of chemical side-effects occur which are frequently objectionable, but these can be reduced by suitable choice of technique. A certain amount of work has also been carried out by the Food Investigation Organization of the D.S.I.R., England.

The use of high velocity electrons and gamma rays has been studied by various workers. The former were obtained from electron accelerators with effective anode voltages usually upto 2 or 3 million volts; upto 15 million volts had been used, however. Gamma rays were obtained from radio-active sources; Cobalt 60, which was being used experimentally, gave radiation with an energy of about 1 Mev. It is important to note that these energies are insufficient to induce radio-activity in irradiated products.

The biological effects of these radiations have

been studied intensively and the ability to kill bacteria has been proved, the general principle being that large organisms are more easily killed than small. The most extensive and reliable figures available had been published by the Department of Food Technology of the Massachusetts Institute of Technology. Their observed sterilisation doses were approximately:

Insects	..	100,000 rep.
Vegetative Bacteria	..	500,000 rep.
Moulds and Yeasts	..	1,000,000 rep.
Bacterial Spores	..	2,000,000 rep.

the "rep" being a very small unit based on the number of ions produced by the radiation. 1,000,000 rep. gave a temperature rise of approximately 2° C. in water under adiabatic conditions. For the present, the general principle should be to determine the sterilisation dose for any given product by direct experiment. In some cases an incomplete kill might be accepted, with a considerable reduction in the dose necessary, but this possibility should be regarded with reserve until the subject has been more fully explored. Viruses usually required larger doses for their destruction, upto 5,000,000 rep. and enzymes even larger, upto 10,000,000 rep. or more, depending on their size. Toxins, etc., would in general be even more resistant. The advantages of the process are: (a) The sterilisation of heat sensitive materials would be possible. (b) Almost any type of sealed container could be used. (c) In some cases new products might be prepared, e.g., new vaccines.

# EMIL FISCHER—BIRTH CENTENARY\*

EMIL FISCHER was born on 9th October 1852, in Euskirchen in Rhenish Prussia. After the termination of his scholastic life he was appointed as instructor in the Strasbourg University. In 1875 he followed his teacher, von Baeyer to Munich where he worked successively as Lecturer, Professor Extraordinary and Director of the Analytical Department of von Baeyer's Laboratory. On the demise of von Hofmann in 1892, Emil Fischer was appointed Professor and Director of the Chemical Institute in Berlin University, a post which he filled with increasing distinction for 27 years until his death.

Fischer's investigations during the first 25 years of his research career mainly comprised work on colouring matters of the rosaniline group, phenyl hydrazine and its compounds with aliphatic and aromatic substances, separation and estimation of arsenic, caffeine, theobromine and xanthine, uric acid, syntheses in sugar group, glucosides, stereochemistry, estimation of amino acids and enzymes.

His investigation on the rosaniline bases led him to conclude that, (1) rosanilines producible from aniline and the toluidines are homologues of which the simplest, pararosaniline, has the composition  $C_{19}H_{17}N_2$  whilst commercial fuchsine is a mixture of which the principal constituent is  $C_{20}H_{19}N_2$  and that, (2) the parent hydrocarbon of the whole group is triphenyl methane of which or of its homologues, the various leucanilines are trimino derivatives.

Although Fischer started his career with research on colouring matter under his master, von Baeyer, he soon diverted and chalked out different lines of work for himself. In 1875 he observed that diazotised aniline on treatment with neutral potassium sulphite yielded, (i) potassium benzene diazonium sulphate,  $C_6H_5N_2SO_3K$ , and (ii) potassium phenyl hydrazino sulphate,  $C_6H_5N_2H_2SO_3K$ . The latter on treatment successively with benzyl chloride and hydrochloric acid yielded benzoic acid and phenyl hydrazine. Thus was born the 'key substance' phenyl hydrazine, which helped Fischer to reveal to us the story of the sugars. Today every student of organic chemistry knows the importance of phenyl hydrazine as a reagent for the identification of carbonyl compounds.

Fischer's major work soon excelled that of von Baeyer: a fact substantiated by the award (1902) of the Nobel Prize to the pupil three

years before it was awarded (1905) to the teacher. Fischer's discovery of organic hydrazines and the effect of phenylhydrazine on aldehydes and ketones led to the establishment of the constitution and to the synthesis of various sugars and to the unravelling of their stereochemistry. His investigations on lichenic substances, depsides and tannin materials have been considered very important. His discovery of soporifics and development of barbiturates like veronal helped the development of synthetic drugs. His investigations in Walden's inversion have become equally classical. Fischer's work on spider's silk revealed that its amino acid make-up is similar to that of natural silk, but while natural silk contained serine and  $\alpha$ -anilino-propionic acid, spider silk contained glutamic acid. Perhaps the rudiments of modern paper chromatography are discernible in one of his papers entitled "Rise of salt solution in bibulous paper".

Fischer's main contribution to industry was the supply of trained personnel. In 1883 the Badische Factory in Germany offered him the lucrative position of the Directorship of the Company. But his love for research made him decline the offer. His development of the barbiturates, substitutes for atropine and strontium chloroarsenobenzenolate as remedy for carcinoma brought him in close contact with synthetic drug industry.

During the years of the First World War, Fischer's services were in constant demand for industrial and technical advice. He presided over two Commissions, one for the production of benzene and toluene, and the other for the utilisation of gypsum and kieserite for the production of sulphuric acid. It was he who as early as 1914 urged the need for the production of synthetic nitric acid from ammonia produced from coke ovens.

H. E. Armstrong, in the obituary article on Fischer, writes of him as "One of Germany's great academic experts—a man who was listened to and used by his Government and simply worshipped by industry". Emil Fischer's achievements will remain for all time a monument of perseverance and industry and a gospel of inspiration and encouragement to all that have the vision and courage to follow him.

\* Summary of the Presidential Address, by Dr. B. H. Iyer to a Colloquium, held on 29th October 1952 in the Indian Institute of Science, Bangalore.

# PRELIMINARY OBSERVATIONS ON THE PLANT MICROFOSSIL CONTENTS OF SOME LIGNITES FROM WARKALLI IN TRAVANCORE

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(University of Lucknow)

SOME samples of lignites from Warkalli, in Travancore, were obtained through the kind courtesy of the Secretary, Industries Section, Development Department of the Travancore-Cochin Government. These lignites which are regarded as Miocene by Krishnan,<sup>7</sup> and which so far as we are aware, have not yet been studied, yielded on maceration a large number of micro-fossils like spores, pollen, cuticles, etc. The present note is a preliminary account of some of the representative types of these micro-fossils. A fuller paper on the subject is under preparation and will be published elsewhere. In this note are described just one type of *Monolete* spore, probably Pteridophytic and nine different types of pollen. These sporomorphs have been classed according to Erdtman<sup>3</sup> as *Nona-perturites*, *Tripurites*, *Triorites*, *Tetracolporites*; *Hexacolporites*; *Tricolpites*; *Septacolpites* and *Octacolpites*. The other terms used in the description of these pollen are borrowed from Erdtman,<sup>2,3,4</sup> Sellinger<sup>5</sup> and Faegri and Iversen.<sup>6</sup> Pollen measuring less than  $35.7\mu$  in both the polar and equatorial views are described as small, others exceeding this measurement are described as large. As far as possible both the polar and equatorial views have been described and sketched.

**Technique.**—The material was allowed to remain in strong nitric acid for at least 12 hours. Then it was repeatedly washed in distilled water and subsequently treated with 10% KOH solution for 2 hours. As the macerated material still showed some silica remains like sand grains, some HF acid was added to it and heated on a sand-bath for an hour. The material was washed again, mounted in pure glycerine and sealed with Canada balsam.

**Comparison.**—The difficulty of comparing fossil pollen with living types is quite obvious. Still wherever it has been possible to institute a comparison with some degree of accuracy it has been done. *Betula nana*, *Cyrtandra lysiose-pala* (A. Gray) C. B. Clarke, amongst the pollen and *Thelypteris palustris* amongst the Pteridophytes offer such comparisons. Two of the sporomorphs described in the present note have also been found in the Palana lignites by Rao and Vimal,<sup>8</sup> and also in the Salt Range (Dandot) lignites (Vimal, Mss.).

## DESCRIPTION

*Monolites* spm. 1.—Grain large, heteropolar, bilateral, yellowish. Plano-convex in lateral view (Fig. 1; Photo 1)  $47.6\mu \times 35.7\mu$ . Narrow in proximal view (Fig. 2). Exine intectate with verrucate surface covered with dome-shaped small projections (Fig. 3)  $5\mu$ – $7\mu$  apart. The grain can be referred to Polypodiaceae, and can be generally compared with the spore of *Thelypteris palustris* (Knox. E.M. 1951, p. 445, Fig. 30) with the difference that the projections are not pointed in our grain.

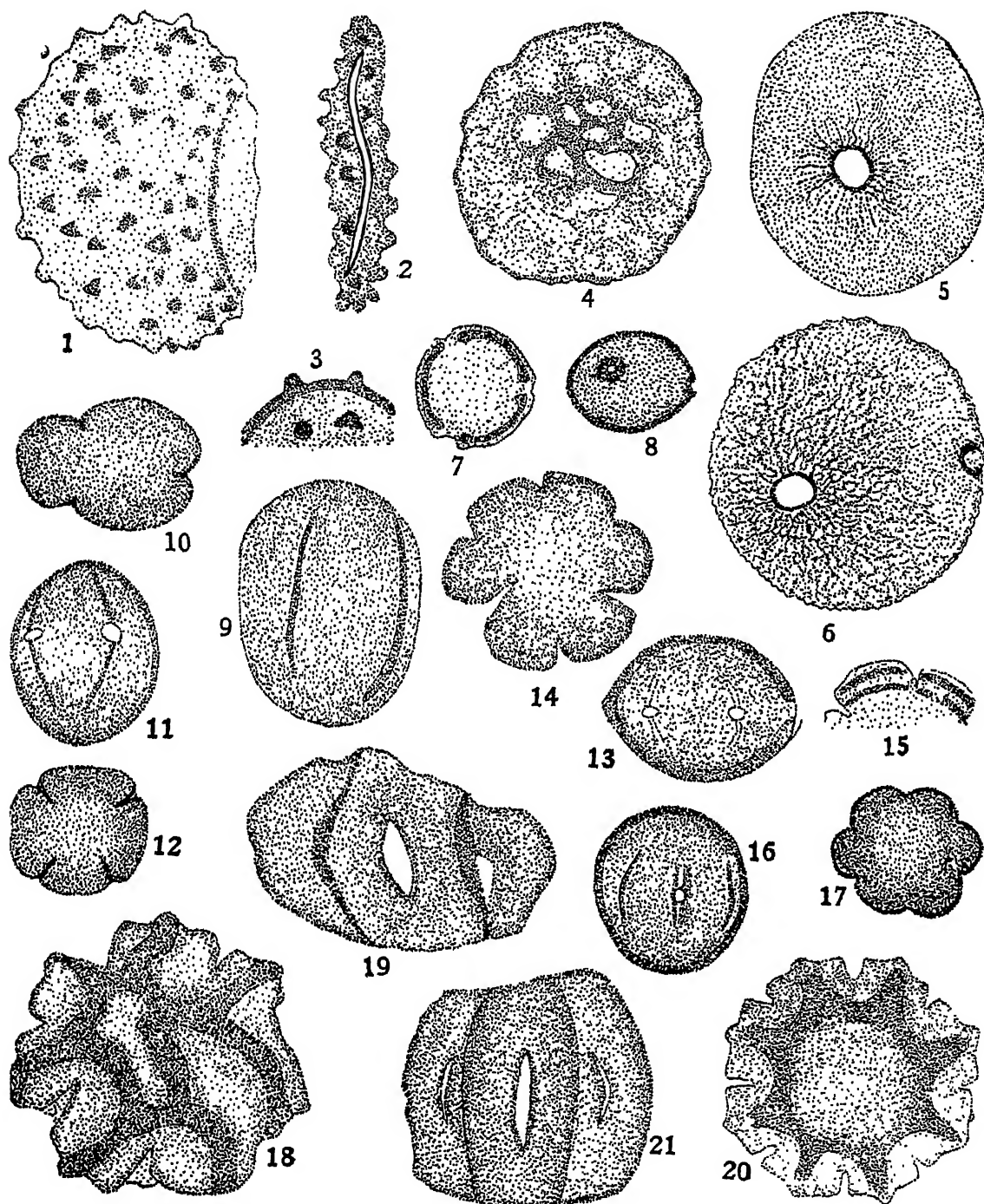
*Reticulonapites* spm. 1.—Grain large, brown, spherical (Fig. 4; Photo 2), apolar, radio-symmetric,  $36.9\mu$  across. Surface sculpture appears reticulate, intectate; columellae simple.

*Tripurites* spm. 1.—Grain large, yellowish, spherical (Fig. 5; Photo 3), flaccid, apolar, bilateral,  $38.1\mu \times 41.6\mu$  across. Triporate, pores oval,  $5.9\mu \times 7.1\mu$  in diameter. Fig. 5 and Photo 3 show one of the pores in focus. Fig. 6 shows the same grain after it has changed its position bringing the other two pores into view. The third pore is on the other side and is not shown in the sketch. Exine  $1.2\mu$  thick, surface sculpture striated.

*Triorites* spm. 1.—Grain small, yellowish, suboblate, isopolar, bilateral. Polar view (Fig. 7) round  $17.9\mu$  across. Pores three, small, equatorial, aspidate (annulate),  $1.5\mu$  in diameter. Equatorial view (Fig. 8; Photo 4), broadly elliptic,  $14.3\mu \times 17.9\mu$  with one pore in focus. Ectoexine about one micron thin. Endoexine  $1.2\mu$  thick. Surface sculpture smooth, intectate. The grain resembles in size as well as shape the grain of *Betula nana* (Erdtman, 1943, p. 74, Figs. 63–65).

*Tricolpites* spm. 1.—Grain large, yellow, prolate, isopolar, bilateral. Equatorial view (Fig. 9; Photo 5),  $35.7\mu \times 23.8\mu$ , showing three flanges and two furrows. Furrows long and narrow, not reaching the poles. Polar view (Fig. 10)  $17.9\mu \times 21.4\mu$ , three-lobed. Endoexine  $1.2\mu$  thick, ectoexine very thin, less than a micron, surface sculpture intectate, smooth. The polar view of this grain resembles in size and surface sculpture the polar view of *Tricolpites* spm. figured by Mrs. Chitaley from the Mohgaon (Fig. 14, Text-Fig. 16).

Kalan deposits (Chitaley, 1951, p. 337, pl. 13,



FIGS. 1-21

FIGS. 1-3. *Menolites*, spm. 1. FIG. 4. *Reticulopites*, spm. 1. FIGS. 5-6. *Triporites*, spm. 1. FIGS. 7-8. *Triaculites*, spm. 1. FIGS. 9-10. *Tetracladites*, spm. 1. FIGS. 11-12. *Tetradactylites*, spm. 1. FIGS. 13-15. *Hexaculporites*, spm. 1. FIGS. 16-17. *Hexaculporites*, spm. 2. FIGS. 18-19. *Septaculites*, spm. 1. FIGS. 20-21. *Octaculporites*, spm. 1.

Explanation of figures in text: All figures are magnified 1,300 times. Figs. 3 and 15 are semidiagrammatic, the rest are *Camera lucida* sketches.



*Tetracolporites* spm. 1.—Grain small, yellowish, subprolate, isopolar, radio-symmetric. Equatorial view (Fig. 11; Photo 6),  $27.3\mu \times 21.4\mu$  oval, showing two porate-furrows on one side. Furrows long (longicolpate) and pores broad (lati-porate),  $2.4\mu \times 4.7\mu$ . Polar view (Fig. 12), squarish, with the furrows at the angles. Exine  $3.7\mu$  thick, smooth. The grain resembles in form and dimensions also, the pollen from Hawaii referred to *Cyrandra lysiosepala* (A. Gray) C. B. Clarke, & Selling (1947, pp. 284-85, Figs. 630-32). The Tetracolporate Hawaiian grains do not show

the pores clearly, but our pollen shows definite and distinct pores.

*Hexacolporites* spm. 1.—Grain small, yellowish, oblate, isopolar, radio-symmetric. Equatorial view (Fig. 13), biconvex,  $33.4\mu$  along the equator and  $23.8\mu$  at right angles to it. Poles rounded, colpæ six, each with one small pore. Polar view (Fig. 14; Photo 7), round, six-lobed,  $29.7\mu$  across. Below the ectoexine are two more layers (Fig. 15). It is difficult to say whether they represent the endoexine or are only special extra layers of the exine itself. Surface sculpture granular. Hexacolpate and Pentacolpate pollen grains of the same size and surface sculpture have been found in the Palana lignites (Rao and Vimal, 1951), but the Palana grains did not show the colpate feature, nor the multi-layered exine.

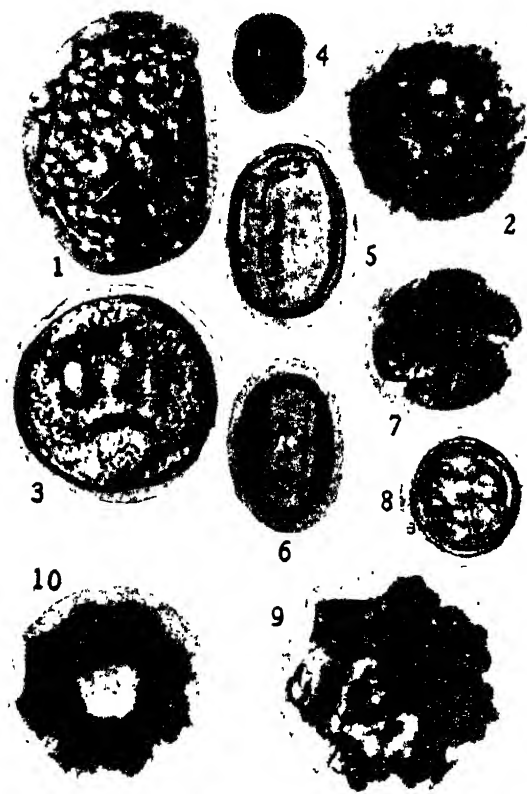
*Hexacolporites* spm. 2.—Grain small, brown, prolate spheroidal, isopolar, radio-symmetric. Equatorial view (Fig. 16; Photo 8) roundish,  $21.4\mu \times 24.9\mu$  pores six, one in each furrow. Pores are big (grandi-porate) and the colpæ are short (brevis-colpate). Polar view (Fig. 17) round, six-lobed, Exine  $1.2\mu$ , intexine granular, surface smooth.

*Septacolpites* spm. 1.—Grain large, brown, oblate, isopolar, radio-symmetric. Polar view (Fig. 18; Photo 9)  $45.4\mu$  across, round. Furrows seven, short, broad, meridianally placed.  $4.7\mu$  broad and  $8.3\mu$  long, but do not reach the poles. Ectoexine less than a micron thin, endoexine comparatively thicker. Surface sculpture rugulate. Equatorial view (Fig. 19), narrow,  $28.5\mu \times 43.9\mu$ , with one furrow in focus.

*Octacolpites* spm. 1.—Grain large, brown, isopolar, radio-symmetric. Polar view (Fig. 20; Photo 10), round, lobed,  $41.4\mu$  in diameter. Equatorial view (Fig. 21) drum-shaped,  $35.7\mu \times 41.4\mu$  and shows the flat poles and the slightly convex sides. Furrows  $11.9\mu$  long and  $1.2\mu$  broad. Surface sculpture granular.

**Acknowledgement.**—We are deeply indebted to the Secretary, Industries Section, Development Department, Government of Travancore and Cochin, for the material and to Dr. R. C. Misra for drawing our attention to these lignites. This investigation was carried out during the tenure of a research scholarship enjoyed by one of us and to this we are very thankful to the Government of India.

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PHOTOGRAPHS 1-10

FIG. 1. Lateral view *Monolites*, spm 1. FIG. 2. *Atraculonapites*, spm. 1. FIG. 3. *Triporites*, spm. 1. FIG. 4. Equatorial view *Priorites*, spm. 1. FIG. 5. Equatorial view *Tricolpites*, spm. 1. FIG. 6. Equatorial view *Tetracolporites* spm. 1. FIG. 7. Polar view *Hexacolporites*, spm. 1. FIG. 8. Equatorial view *Hexacolporites*, spm. 2. FIG. 9. Polar view *Septacolpites*, spm 1. FIG. 10. Polar view *Octacolpites* spm 1.

All photographs are from untouched negatives and are magnified 680 times.



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## INTERNATIONAL GEOPHYSICAL YEAR: 1957-58

IN 1882, scientists co-operated in studies which they called the first International Polar Year. This was concerned with the investigation of such geophysical phenomena as magnetic storms and the aurora. It was believed at that time that the aurora were a reflection of light from icebergs at the North Pole, but this was disproved when it was found that aurora did not increase in frequency as one went further north. The second Polar Year was arranged fifty years later, principally to gather data about magnetic storms. Facts ascertained at that time are still being studied.

Now it is planned in 1957-58 to change the name to the International Geophysical Year, reflecting the more comprehensive purposes of the studies, and to have about 150 ionospheric observatories ready for action. The original idea

for this Geophysical Year came from Sydney Chapman (Britain) and Lloyd V. Berkner (America). The investigation is so vast that a Central Planning Committee is being set up, with a Secretariat that will remain in being for five years afterwards to organize analysis of the data. These data are bound to be useful to the scientists working at the International Seismological Summary in Kew, England, where earthquakes are mapped; the International Isostatic Institute in Helsinki, Finland, concerned with the ever more exact determination of the changing shape of the earth; the International Latitude Service in Turin, Italy; and the Bureau de L'Heure, in Paris, France, that gives us our internationally accepted time signals.

## THE GREAT KAMCHATKA EARTHQUAKE OF NOVEMBER 4, 1952

A VERY great earthquake (Sequake) shock with its epicentre now fixed by the U.S. Coast & Geodetic Survey at  $52^{\circ} \frac{1}{2}$  N. lat., and  $159^{\circ}$  E. long., near the East Coast of Kamchatka, with its time of origin at  $16^h 58^m 20^s$  G.M.T., was recorded by the seismographs of the Colaba Observatory on the night of the 4th-5th November 1952. The shock was of very great intensity and has been assigned magnitude  $8\frac{1}{2}$ , same

order as the great Assam earthquake of August 1950. It was followed by 28 aftershocks upto November 16th, 1952, some of which could themselves be classified as moderate earthquakes. The main shock gave rise to a huge tidal wave which affected North Japan Islands and spread over North Pacific. No information is yet available regarding the damage in the neighbourhood.

## VACUUM FUSION APPARATUS

VACUUM fusion gas analysis apparatus is finding increasingly wide use in laboratories engaged in quality control work, as well as research and development. National Research Corporation have developed the type 09-1240 vacuum fusion unit, which is convenient and versatile. It combines features which have been developed in the laboratories of National Research as well as in outstanding analytical laboratories all over the world.

A wide variety of ferrous and non-ferrous pure metals and alloys including titanium, molybdenum, stainless steels, high temperature alloys, and electronic alloys can be quantitatively analyzed for total oxygen, nitrogen and hydrogen content. Sensitivity as high as one part in ten million is possible. A high degree of accuracy and reproducibility is possible with proper operation which can easily be mastered by the analyst.

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SOME MEASUREMENTS ON THE  
DIELECTRIC POLARISATION OF  
ALCOHOL MIXTURES

THE dielectric polarisation of mixtures has been used as a means of detecting molecular association. In this experiment we determined the dielectric constants of normal butyl and normal amyl alcohols ( $C_4H_9OH$  and  $C_5H_{11}OH$ ) for the pure liquids and also for their different concentrations in mixtures. The dielectric constants  $\epsilon$  were measured in a gold-plated co-axial cylindrical test condenser, the coatings of which could be separated and readjusted to a high degree of precision. The test condenser was kept at a temperature of 32° C. in a thermostat. The electrical circuit consisted of two radio-frequency oscillators, one of which was a Franklin Master Oscillator. The adjustments were made by the zero beat principle, and capacities

could be measured on a wide calibrated scale to 0.1 micro-micro farad. The entire apparatus was assembled in the laboratory. Table I gives the results of the study.

TABLE I

Proportion of $C_4H_9OH$ %	Density $d$ (g./c.c.)	Dielectric constant $\epsilon$	Total polarisation $P_T$ (c.c.)
100	.7971	15.44	769.6
90	.7981	15.16	778.8
80	.7995	15.00	789.4
70	.8000	14.85	798.9
60	.8005	14.32	807.2
50	.8011	14.16	818.7
40	.8013	13.87	829.2
30	.8015	13.77	842.4
20	.8023	13.58	854.9
10	.8036	13.23	865.2
0	.8034	13.18	880.0

The last column gives the total polarisation  $P_T$ , calculated from the formula

$$P_T = \frac{\epsilon - 1}{\epsilon - 2} \cdot \frac{f_1 M_1 + f_2 M_2}{d}$$

where  $M_1$  and  $M_2$  are the respective molecular weights,  $f_1$  and  $f_2$  are the molar fractions of the two components and  $d$  is the density of the mixture.

The curve between the total polarisation and the concentration was found to be almost, though not quite, linear showing that no marked association takes place between the molecules of the two alcohols.

Our best thanks are due to Messrs. Prakash Chandra Sood and Raj Kumar Vij for help in taking the observations.

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Panjab University College,  
Hoshiarpur,  
July 14, 1952.

H. R. SARNA.  
P. N. TREHAN.

### EFFECT OF HEAT ON THE FREQUENCY OF THE R.F. OSCILLATIONS IN A.C. 'SILENT' DISCHARGES

DIRECT experimental evidence of R.F. oscillations of discrete frequencies in an ozonizer or in a discharge tube fitted with external 'sleeve'-electrodes and excited by a suitable high voltage of 50 c.p.s. has already been reported.<sup>1</sup> The object of the present communication is to show the effect of thermal radiations on the frequency of the R.F. oscillations produced in hydrogen, chlorine and iodine vapour under A.C. excitation in discharge tubes fitted with external 'sleeve'-electrodes.

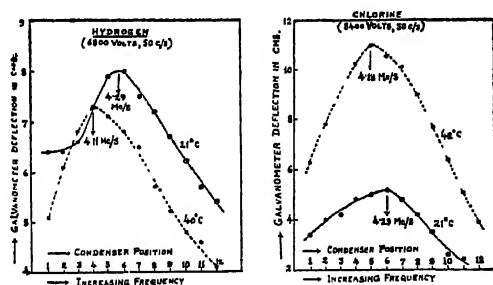


Fig. 1

The hydrogen discharge tube (pressure: 97 mm.) was excited by 6,800 volts of 50 c.p.s. The excitation voltage for the chlorine discharge tube (pressure: 30 mm.) was about 5,400 volts (50 c.p.s.), while the iodine vapour enclosed at saturation vapour pressure in the discharge tube was excited by 900 volts (50 c.p.s.). In all the cases, the resonance

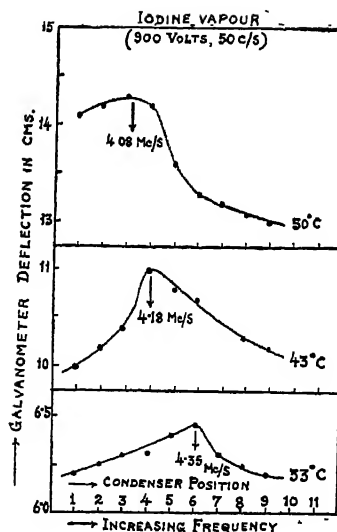


FIG. 2

maximum was found to shift towards lower frequency (or longer wavelength), as the temperature was increased. The temperature of the discharge tube was raised by exposing it to thermal radiation from a set of heater coils placed at some suitable distance. The experimental data are given in Table I.

TABLE I

Gas or vapour under 'silent' discharge	Temperature in degrees (Centigrade)	Frequency of R.F. oscillations (Mc/s)
1 Hydrogen ..	21	4.29
	40	4.11
2 Chlorine ..	21	4.29
	42	4.19
3 Iodine vapour ..	33	4.35
	43	4.18
	50	4.08

It should be mentioned that the frequency of the R.F. oscillation in the A.C. discharge was not found to decrease proportionately with the increase of temperature. The experimental results for hydrogen and chlorine are shown in Fig. 1, and those for iodine vapour in Fig. 2.

Detailed investigation is in progress.

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Banaras Hindu University,  
August 8, 1952.

1 Khastgir, S. R. and Setty, P. S. V. *Curr. Sci.*, July, 1952, 21, 197.

## THE EMISSION BANDS OF ANILINE

THE 2,600 Å system of aniline bands has been studied by various authors in absorption. Ginsberg and Matsen<sup>1</sup> have given the analysis of the double-headed bands and also record a considerable number of single-headed ones. Terezin, *et al.*,<sup>2</sup> have studied the same bands in fluorescence. We have been able to excite these bands in emission by transformer, high frequency, condensed spark and ozoniser type of discharges through flowing aniline vapour at room temperature.

Fig. 1 shows in juxtaposition the emission and the absorption bands. (a) is the spectrogram of the emission bands excited by h.f. discharge in flowing vapour while (b) is that of absorption bands obtained in a 10 cm. cell at the saturated vapour pressure at a temperature of 30° C. Both spectra were recorded on a medium Hilger Quartz Spectrograph. It is clear from this plate that the emission bands belong to the same system as the absorption bands. In emis-

under varying conditions of vapour and its excitation, it is of interest to note that under optimum conditions for the excitation of the bands reported here, it is only the 0-0 sequence of the violet cyanogen bands that is recorded with any appreciable density.

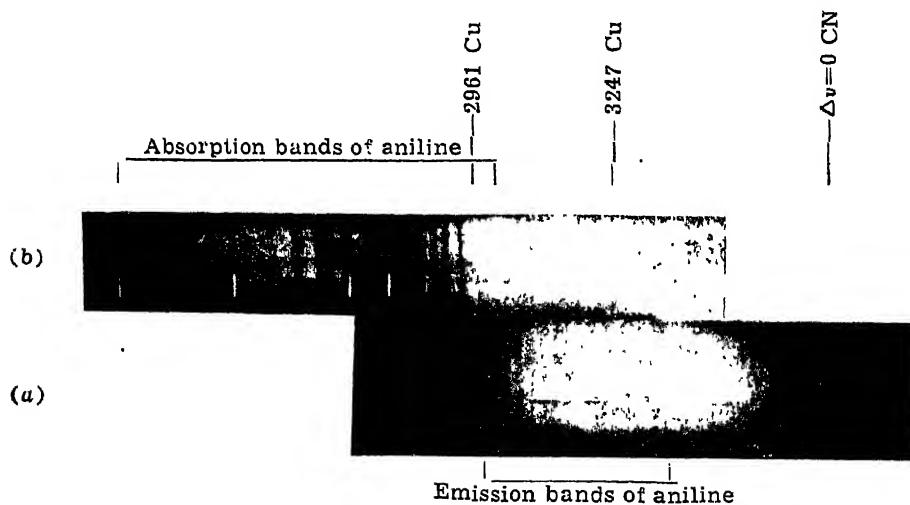
Attempts to improve the intensity of the aniline bands are in progress with a view to photograph them on instruments of higher dispersion. Details will be published elsewhere.

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B. N. BHATTACHARYA (JR.)

Spectroscopy Laboratory,  
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July 23, 1952.

1. Ginsberg and Matsen, *J. Chem. Phys.*, 1945, **13**, 167.
  2. Terezin, Vartanian and Neporent, *Trans. Faraday Soc.*, 1939, **35**, 39.
  3. Kato and Someno, *Sci. Pap. Ins. Phy. Chem. R's.*, 1937, **33**, 209.
- Herzberg and Kolsch, *Zeit. Electrochem.*, 1933, **39**, 572.



sion most of the bands lie on the longer wavelength side of the 0-0 band which suffers self-absorption. The bands become more and more closely packed towards the longer wavelengths where they are overlapped by a continuum.

The diffuse bands reported by Herzberg, Kolsch, Kato and Someno<sup>3</sup> and attributed to localized excitation in  $\text{NH}_2$  orbitals, lying in the still shorter wavelength side of the 2,600 Å system are not recorded on our plates. It is possible that they are self absorbed but this is doubtful as the principal line of carbon (2,478 Å) lying in the same region is recorded on the plate.

While it is not the purpose of this note to deal with the dissociation products obtained

#### A NOTE ON MEGASPORES FROM LOWER GONDWANA COAL OF UMARIA COALFIELD, DIST. SAHDOL (VINDHYA PRADESH)

SOME samples of coal for the microscopic study were collected from the Umaria Seam of Umaria field (23° 32' : 80° 51') of the Son-Rewa-basin. The coal was macerated in pure concentrated nitric acid and it yielded a large number of megaspores along with a great bulk of microspores, woods and cuticles.

So far only a few megaspores have been reported in this country and most of the Lower Gondwana coals, *e.g.*, Raniganj and Jharia coals do not show any megaspores. Hence their presence in Umaria coal may offer an unusual

opportunity for obtaining definite information of the plant population contributing to this particular field. Variation of the initial plant constituents is one of the important causes for the origination of different types of coal. Type classification is fundamental in the differentiation of coals, but unfortunately its achievement has been delayed because of imperfect knowledge of the plant components. Shitholey<sup>1</sup> studied a megaspore cast from the Triassic of Sakl Range, one megaspore has been recorded from the Upper Tertiary of Assam<sup>2</sup> and Trivedi<sup>3</sup> has recorded some megaspores from the Lower Gondwana rocks of Singrauli coalfield, Mirzapur District. Besides these, the author has not come across any other published record of megaspores from India.

The megaspores (Figs. 1 and 2) are radially symmetrical showing definite proximal and distal aspects according to relationship established in the original spore tetrads. The proximal side is marked by triradiate sutures "radiating equally or nearly so from the centre of elaborate equivalent structures arising at the extreme margin of contact between sister spores of the original tetrads". The distal surfaces are smooth and variously ornamented. Ornamentation is generally less well developed on the proximal than on the distal surfaces. Megaspores vary greatly in size from  $250\mu$  to 1 mm. in diameter (some increase is of course due to their flattening). Most of them are very well preserved and exhibit triradiate mark and ornamentation very clearly.



FIG. 1. Megaspore with triradiate sutures,  $\times 25$ .

FIG. 2. Megaspore showing 'central body' presumably shrunken endospore,  $\times 25$ .

In Fig. 1 the megaspore measured from one radial extremity to the opposite margin ranges from  $260\mu$  to  $320\mu$ . Body diameter is slightly less than  $0.5\text{ mm}$ . The body is round to slightly oval or cuneiform. A triangular appearance is imparted by the triradiate apparatus thickening in these areas. However, the triangular appear-

ance is frequently more apparent than real. The body is brown in colour in reflected light. The whole body of the megaspores is reticulately to matte textured. In some megaspores as in Fig. 2 dark 'central body' is seen which "is considered to be a shrunken endosporeal membrane which in modern spores is connected with the outer layer of spore coat near the apex. Its presence as a shrunken sac may indicate that the gametophyte in these cases was abortive when the spores were deposited, otherwise the endospore probably would have been distended against the mesospores and exospore."<sup>4</sup>

The present discovery of megaspores in great abundance is therefore of interest. It affords evidence of the existence of Lycopods in the Palaeozoic of India<sup>5</sup> whose presence is otherwise unknown. These megaspores show an affinity with the free sporing Lycopods of Triletes species chiefly *T. triangulatus zerndt.* var *zonatus* (Ibrahim).<sup>4,5</sup>

Fuel Res. Inst.,  
Jeolgora,  
August 20, 1952.

B. TRIPATHI.

1. Shitholey, R. V., *Proc. Nat. Acad. Sci. Ind.* 1943, 13.
2. —, *Jour. Ind. Bot. Soc.* 1947, 26.
3. Trivedi, B. S., *Current Science*, No. 9, April 1950.
4. Schopf, J. M., *Report of Investigation*, No. 50 of Illinois State, 1938, p. 32, 37\*.
5. —, Wilson and Bental, *Ibid*, No. 91, Illinois State, 1944.

\* F spores from the Herrin (No. 6) Coal Bed in Illinois.

## ELECTRODEPOSITION OF CADMIUM-ZINC ALLOYS FROM THE SULPHAMATE-BATH

CADMIUM-ZINC alloy deposition finds application in the protective finishing of metals. An alloy containing 40 to 60% zinc affords very good protection to mild steel. It is usually deposited from cyanide solutions, though acid sulphate solutions have also been studied.<sup>1,2</sup>

The electrodeposition of cadmium from the sulphamate-bath has been reported by Mathur and Rama Char,<sup>3,4</sup> Piontelli<sup>5,6</sup> and Choguill,<sup>7</sup> and of zinc by the latter authors.<sup>5,6,7</sup> Experiments conducted in this laboratory have shown that extremely adherent, light grey, dense and fairly well distributed zinc deposits can be obtained on steel from N, 2N and 3N zinc sulphamate solutions at  $25^{\circ}\text{C}$ . in the c.d. range  $1.6\text{--}8.1\text{ amp./dm.}^2$  with cathode efficiencies over 97% using zinc anodes. Measurements of the cathode potentials of cadmium and zinc and of alloy deposition potentials<sup>8</sup> in sulphamate

solutions indicated the possibility of co-depositing the two metals from these solutions. In this investigation the work on co-deposition has been restricted to the study of the influence of the common variables in alloy deposition. The only previous work on cadmium-zinc deposition from the sulphamate-bath is that of Piontelli and Canonica<sup>9</sup> who have not given details of their experimental results but stated that the deposits were in general not very promising, being spongy, irregular and variable as regards crystalline grain and appearance.

The plating-bath contains zinc sulphamate, cadmium sulphamate and free sulphamic acid to adjust the pH. The co-deposition has been studied in detail, using steel cathodes and cadmium anodes. The effect of c.d. on alloy deposit composition is shown in Table I.

TABLE I

Bath Composition: 65 gm./L zinc, 13 gm./L cadmium, 220 gm./L total sulphamate (as sulphamic acid) pH = 2, Temp. = 25° C.  
Vigorous stirring

Cathode c.d. amp./dm. <sup>2</sup>	Composition of deposit	
	Cadmium %	Zinc %
0.97	94	6
1.93	68	32
2.90	44	56
3.39	18	82
3.87	8	92

The cadmium content in the alloy deposit decreases as the c.d. is increased. At constant c.d., the cadmium content increases by increasing the temperature, pH, or cadmium content of the electrolyte and by agitation. The deposit composition depends only on the ratio of cadmium to zinc in the electrolyte and is unaffected by the total metal content if this ratio is maintained constant.

Deposits analysing 8 to 98% cadmium (92 to 2% zinc), can be obtained by varying the operating conditions. They are, however, of poor quality, darkening in colour as the zinc content increases and generally of a coarse crystalline nature. The addition of a 0.1 gm./L each of glue, thiourea and dextrin effects slight improvement. The throwing power of the plating solution is fairly good.

Our thanks are due to Prof. K. R. Krishnaswami, for giving facilities and taking interest in the work,

Electro-Chemistry Lab., J. MATHUR.  
Dept. of General Chem., T. L. RAMA CHAR,  
Indian Inst. of Science,  
Bangalore-3,  
August 30, 1952.

1. Fink and Young, *Trans. Electrochem. Soc.*, 1935, **67**, 311.
2. Parks and LeBaron, *Ibid.*, 1936, **70**, 373.
3. Mathur and Rama Char, *Proc 35th Indian Science Congress*, Part III, 1952, 237.
- 4.— *J. Sci. Ind. Res.*, India, (*Under publication*).
5. Piontelli and Guilotto, *Chem. Abs.*, 1940, **34**, 677.
6. Piontelli, *Ibid.*, 1944, **38**, 2371.
7. Choguill, *Ibid.*, 1940, **34**, 5351.
8. Parks and LeBaron, *Trans. Electrochem. Soc.*, 1936, **69**, 599.
9. Piontelli and Canonica, *Proc. 3rd Internat. Electrodep. Conference*, E.T.S., 1948, 121.

## ELECTRODEPOSITION OF TIN FROM THE PYROPHOSPHATE-BATH

TIN is commercially electrodeposited from the acid sulphate and alkaline stannate solutions. The acid-bath has some advantages over the alkaline-bath in respect of current efficiency, plating speed and bath voltage, but its throwing power is poor. The bath composition and the anodic reaction has, however, to be carefully controlled in both cases, as otherwise there is a tendency for the precipitation of insoluble salts and the formation of faulty deposits.

The present investigation is concerned with the electrodeposition of tin from a new type of bath, namely, the pyrophosphate-bath, prepared by adding sodium pyrophosphate to stannous pyrophosphate, a complex being formed. The only mention of the use of this bath for electrodeposition appears to be the very old Roseleur solution of 1850,<sup>1,2</sup> consisting of stannous chloride and sodium pyrophosphate.

A detailed study has been made of the effect of concentration of tin and pyrophosphate, current density, temperature, agitation, pH and addition agents on the electrodeposition. The conductivity of the plating solution has been measured as also the cathode and anode polarization under varying conditions. The bath gives smooth, white, bright, adherent and readily polishable deposits of good quality. It can be worked satisfactorily over a wide range of experimental conditions. The cathode and anode efficiencies are very nearly 100% and anode corrosion is good. Increase in the concentration of metal increases the c.d. range. Increasing the ratio of total pyrophosphate to metal increases the conductivity and to a small extent the c.d.

It is not advisable to go beyond the ratio 5 : 1, as an excess of pyrophosphate tends to crystallize the bath, especially when the temperature falls.

Increase of temperature or bath agitation raises the limiting c.d. Small variations in pH are of little significance but above pH 10.5, dark, spongy deposits are obtained. Although the bath is satisfactory by itself, several addition agents have been tried with a view to effect an improvement in its performance. The best results are obtained with a combination of gelatin and dextrin. They increase the limiting c.d. and the brightness of the deposit.

The optimum conditions are: tin (stannous): 22-33 gm./L, total pyrophosphate: 112-68 gm./L, gelatin: 1 gm./L, dextrin: 10 gm./L, cathode: steel or copper, anode: tin, temp.: 60-80° C., pH: 8.0-9.5, c.d.: 1.1-4.4 amp./dm.<sup>2</sup>, stirring, voltage: 0.4-0.8 volts, time required for plating 0.001" at 2.2 amp./dm.<sup>2</sup>: 25 minutes.

The tin pyrophosphate-bath compares well with the sulphate-bath in c.d. range, current efficiency, quality of plate, plating speed, cost of plating solution, bath voltage and ease of control and maintenance. The deposits are bright and the throwing power of the solution is quite good. In view of these considerations, this bath appears to be suitable for the electrodeposition of tin.

Our thanks are due to Prof. K. R. Krishnaswami, for giving facilities and taking interest in the work.

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Dept. of General Chem., T. L. RAMA CHAR.  
Indian Inst. of Science,  
Bangalore-3,  
August 30, 1952.

1. Kern, *Trans. Electrochem. Soc.* 1913, **23**, 193. 2. Oplinger and Bauch, *Ibid.* 1941, **80**, 617.

# IRON CONTENT OF INDIAN COMMERCIAL SUGARS AND ITS INFLUENCE ON THE CITRIC ACID PRODUCTION BY *ASPERGILLUS* *NIGER*

WITH a view to finding out the suitability of commercial sugars available in the country for use in citric acid production by *Aspergillus niger*, forty-seven samples of cane sugar produced by different factories in India were analysed for iron, colorimetrically, using  $\alpha$ - $\alpha$ -dipyridyl. Results are given in Table I.

TABLE I

Iron content 10 <sup>-5</sup> g. per 100 g.	Number of samples analysed	Colour of samples
10-15	12	White
15-20	10	
20-25	13	
25-30	4	Pale grey
30-35	6	
50-80	2	Grey

In conformity with the known influence<sup>1,2</sup> of iron and other heavy metals present in cane sugar on the production of citric acid from this sugar, we have found a good correlation between the iron content and citric acid yield as given in Table II. A citric acid producing strain of *Aspergillus niger*, (NRRL 67) was used in these experiments.

TABLE II

Sugar* sample	Iron content 10 <sup>-5</sup> g per 100g	Per cent. sugar meta- bolised	Conversion per cent.
1 A. R. Sucrose	Nil	98.2	52.1
2 2 (M)	26	87.5	45.1
3 11 (a)	10	91.8	54.1
4 11 (b)	12	92.2	53.0

\* (M), (a) and (b) refer to different sources of commercial sugar.

Whiter varieties of commercial sugars containing less iron than the greyer varieties are therefore more suitable for citric acid production. Removal of the suspended impurities in the sugar solutions is desirable as a general rule, since, like unsprouted spores,<sup>3</sup> they may have a toxic effect towards citric acid production.

The authors' thanks are due to Dr. V. Subrahmanyam, Director of this Institute, for his keen interest and valuable suggestions.

Central Food Technological Research Institute,  
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August 8, 1952.

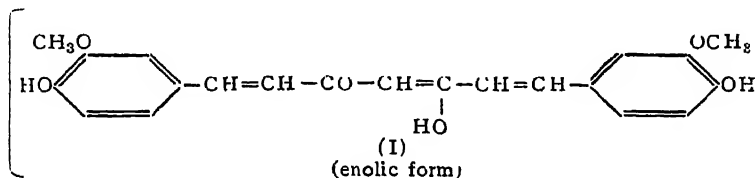
1. Perlman, *et al.*, *Arch. Biochemistry*, 1946, **11**, 131.  
2. Shu and Johnson, *Ind. Eng. Chem.*, 1948, **40**, 1202.  
3. Doelger and Prescott, *Ibid.*, 1934, **26**, 1142.

## THE COLORING MATTER IN TURMERIC

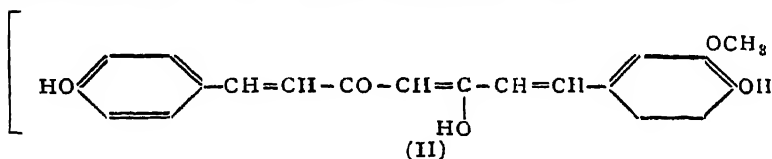
WHEN an attempt was made to estimate curcumin in turmeric using a solution of boric acid and oxalic acid in glacial acetic acid as the color forming reagent and crystalline curcumin as a

reference standard, it was found that the color obtained with turmeric extract was slightly different from that obtained with pure curcumin. With turmeric extracts, the solution exhibited a pronounced orange fluorescence which was absent in the reference solution. This pointed to the possible presence of another substance, or substances besides curcumin, in turmeric, which was responsible for this fluorescence. A careful search of the literature showed that no information on this point also was available.

1. Curcumin whose structure was determined (DFM) (I).

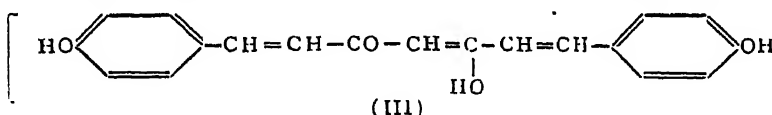


2. The second constituent of the turmeric pigments is (II).



Hydroxy-cinnamoyl-feruloyl-methane (HCFM).

3. The third fraction is Dihydroxy-dicinnamoyl-methane (DDCM) (III).



It was therefore decided to carry out a chromatographic analysis of the pigments in turmeric. Extracts of powdered turmeric in benzene were passed through a column of silica gel. Development of the chromatogram with benzene showed three distinct zones and a few minor ones. These were isolated as liquid chromatogram in separate receivers. On concentrating the solutions by evaporation under reduced pressure, the substances were thrown out of solution; the crystals were filtered, washed with benzene, dried and recrystallised from ethanol. The fraction first to leave the column was the major constituent, and consists of curcumin, obtained as orange yellow prisms melting at 183° C. The second fraction was an amorphous yellow powder melting at 168° C. while the third crystallised out in yellow plates melting at 224° C. This fraction produces with boric-oxalic acid reagent a pink color with a brilliant orange fluorescence.

The molecular weights, methoxyl values, chemical reactions, absorption spectra, etc., showed that the three substances are related to each other. Thus while curcumin has 2 methoxy groups in its molecule, the second fraction has only one and the third has none.

The structure of these three substances could be represented as follows.

Besides these major constituents, three minor fractions were also isolated. Their reactions and properties indicate that they are the geometrical isomerides of the three major constituents mentioned by Kostanecki, *et al.*,<sup>1</sup> is diferuloyl methane

tioned above. The detailed account is being published elsewhere.

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August 8, 1952.

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1. Milobedska, Kostanecki, and Lampe, *Ber.*, 1910, 43, 2163.

#### FORMATION AND REACTION OF $\beta\beta$ -DISUBSTITUTED $\alpha$ -KETO-GLUTARIC ACIDS

A GENERAL method<sup>1</sup> for the synthesis of  $\alpha$ -keto-glutaric acids consists in treating  $\alpha\alpha'$ -dibromoglutaric acids with aqueous or alcoholic potash followed by hydrolysis of the intermediate hydroxy-, or alkoxy-cyclopropane acids first formed. According to the alternative method of Bardhan<sup>2</sup>  $\alpha\alpha$ -di-substituted succinic acids are converted according to known method through



TABLE I

Compound	M.P. or B.P.	Analysis		Molecular weight by titration
		C	H	
Methylhydrogen- $\alpha$ -diethyl succinic acid	.. m.p. 46-47°	57.2 (57.4)	8.1 (8.4)	183.8 (183)
Methyl $\beta$ -diethyl-levulic acid	.. b.p. 120°/10 mm.	64.6 (64.5)	9.8 (9.7)	
Semicarbazone	.. m.p. 115-16°	54.2 (54.3)	8.7 (8.6)	
$\beta$ -Diethyl levulic acid*	.. " 114°	62.6 (62.8)	9.5 (9.3)	72.2 (72)
Semicarbazone	.. " 168-69°	52.4 (52.6)	8.5 (8.3)	
Methyl $\beta$ -diethyl- $\beta$ -benzoylpropionate	.. b.p. 181-83°/8 mm.	72.2 (72.6)	8.2 (8.1)	
$\beta$ -Diethyl $\beta$ -benzoylpropionic acid*	.. m.p. 92°	71.8 (71.9)	7.5 (7.7)	
Semicarbazone	.. " 129-30°	61.7 (61.8)	7.0 (7.2)	
$\gamma$ -Phenyl $\beta$ -diethyl butyric acid	.. " 53-54°	76.1 (76.4)	9.2 (9.1)	220.8 (220)
$\alpha$ -Keto- $\beta$ -diethyl-glutaric acid**	.. " 127-28°	53.3 (53.5)	6.8 (6.9)	202 (202)
Quinoxaline derivative	.. " 201-02°	65.8 (65.7)	6.3 (6.6)	
Semicarbazone	.. " 180-81°			
$\beta$ -Diethyl glutaric acid <sup>5</sup> (Clemmensen)	.. " 108°			
<i>ns</i> -Dipropyl succinic acid	.. " 84°	59.4 (59.4)	8.9 (8.9)	202.6 (202)
Anhydride	.. b.p. 161-62°/34 mm.	65.3 (65.2)	8.9 (8.7)	
Methyl $\beta$ -dipropyl levulic acid	.. " 106°/6 mm.	67.4 (67.3)	10.1 (10.3)	
Semicarbazone	.. m.p. 163°	57.4 (57.5)	9.5 (9.4)	
$\beta$ -Dipropyl levulic acid semicarbazone	.. " 193°	56.3 (56.0)	8.0 (8.9)	
Methyl $\beta$ -dipropyl- $\beta$ -benzoylpropionate	.. b.p. 171°/5 mm.	73.9 (73.9)	8.8 (8.7)	
$\beta$ -Benzoyl- $\beta$ -dipropyl propionic acid*	.. m.p. 101-02°	73.3 (73.3)	8.4 (8.4)	232.2 (262)
$\beta$ -Dipropyl $\gamma$ -phenyl butyric acid (Clemmensen)	.. " 153-54°	77.5 (77.4)	9.9 (9.7)	248.2 (248)
$\alpha$ -Keto $\beta$ -dipropyl-glutaric acid**	.. " 104-05°	66.7 (66.7)	9.6 (9.6)	198.4 (198)
Semicarbazone	.. " 185-86°			
Quinoxaline-derivative	.. " 248°	67.3 (67.5)	7.0 (7.3)	
$\beta$ -Dipropyl glutaric acid <sup>7</sup> (Clemmensen)	.. " 113-14°			
Methyl <i>trans</i> - $\beta$ -decalin-2-acetyl-2-acetate	.. b.p. 185°/5 mm.	71.5 (71.4)	9.4 (9.5)	
<i>trans</i> - $\beta$ -Decalin-2-acetyl-2-acetic acid*	.. m.p. 118-19°	70.6 (70.6)	9.3 (9.2)	238.6 (238)
Methyl <i>trans</i> - $\beta$ -decalin-2-benzoyl-2-acetate	.. b.p. 210°/4 mm.	76.5 (76.4)	8.3 (8.3)	
<i>trans</i> - $\beta$ -Decalin-2-benzoyl-2-acetic acid	.. m.p. 157-58°	75.9 (76.0)	8.2 (8.0)	300 (300)
<i>trans</i> - $\beta$ -Decalin-2-benzyl-2-acetic acid (Clemmensen)	.. " 178°	79.7 (79.7)	9.2 (9.1)	286.8 (286)
$\alpha$ -Keto <i>trans</i> - $\beta$ -decalin-2 : 2-diacetic acid**	.. " 156°	62.6 (62.7)	7.6 (7.5)	268.2 (268)
Quinoxaline derivative	.. " 230°			
<i>trans</i> -Decalin-2 : 2-diacetic acid (Clemmensen) ..	.. " 175°			

the half-ester chloride into the corresponding levulic acids which on oxidation with alkaline potassium permanganate afford the corresponding  $\alpha$ -keto-glutaric acids in good yield. A number of these acids have now been prepared according to this method and their action on hot concentrated aqueous alkali has been examined. The important fact emerges that all the keto-glutaric acids examined in this connection can be recovered unchanged and the supposed existence<sup>3</sup> of keto-cyclol tautomerism between the keto acid (I) and the hydroxy-cyclopropane acid (II) when R = ethyl or *n*-propyl cannot be substantiated.



The compounds in Table I were prepared by this method. Those marked with an asterisk showed no change on reaction with hot aqueous

alkali. Quantities within brackets are those expected from molecular formula.

I wish to thank Prof. J. C. Bardhan for his interest in the progress of this work.

Organic Chemistry Lab., K. C. BHATTACHARYA.  
University College of Science,  
Calcutta-9,  
August 11, 1952.

1. Perkin and Thorpe, *J.*, 1901, 79, 737. 2. Bardhan, *J.*, 1928, 2604; also Khuda and Bhattacharyya, *J. Ind. Chem. Soc.*, 1947, 15. 3. Deshapande and Thorpe, *J.*, 1922, 121, 1430; Bains and Thorpe, *Ibid.*, 1923, 1208; Baker, *Tautomerism*, p. 176. 4. Deshpande and Thorpe, *loc. cit.*, p. 1430. 5. Guareschi, *Atti Accad. Sci. Torino*, 1900-01, 34 443; Vogel, *J.*, 1934, 1761. 6. Bains and Thorpe, *J.*, 1923, 1208. 7. Guareschi, *Gazzette*, 1919, 49, i, 124, also Bains and Thorpe, *loc. cit.*, p. 1209. 8. Rao *J.*, 1930, 1162.

# ORIENTATION IN THE THIAZOLE NUCLEUS

In the course of our studies on the orientation in the thiazole nucleus, we have brominated and nitrated a number of thiazole derivatives. In view of the recent publication by Prijs, Mengisen, Fallab and Erlenmeyer,<sup>1</sup> we record below our findings.

2-Methylthiazole, on bromination (at 100° C.) furnishes 2-methyl-5-bromothiazole, and on nitration (at 100° C. for 10 hours and at 120° C. for 4 hours), yields 2-methyl-5-nitrothiazole (m.p. 120-21° C.). 4-Methylthiazole could not be brominated; on nitration it gives a nitro compound, m.p. 58-59° C. shown to be 4-methyl-5-nitrothiazole.<sup>2</sup> 5-Methylthiazole on bromination yields a bromo compound which, heated with sulphanilamide, potassium carbonate and copper powder, furnishes 2-sulphanilamido-5-methylthiazole; hence the bromo compound should be 2-bromo-5-methylthiazole. On nitration, 5-methylthiazole furnishes a nitro compound, m.p. 110° C., which, not being identical with 2-nitro-5-methylthiazole, m.p. 61° C.,<sup>2</sup> should be 5-methyl-4-nitrothiazole.

2-Hydroxythiazole (m.p. 69-70° C.) prepared by the action of chloroacetaldehyde on ammonium thiocarbamate, on bromination furnished 2-hydroxy-5-bromothiazole (m.p. 67° C. decomp.), on nitration 2-hydroxy-5-nitrothiazole (m.p. 146-47° C.), and on treatment with acetic anhydride, 2-hydroxy-5-acetylthiazole (m.p. 195-97° C.).

5-Acetaminothiazole on bromination, even with one molecular equivalent of bromine, yielded only the dibromo derivative, 2:4-dibromo-5-acetaminothiazole, m.p. 148-49° C., as reported by Prijs, *et al.*;<sup>1</sup> the mono-bromo derivative could not be obtained. When 5-acetaminothiazole-2-carboxylic acid (F) was brominated, instead of the 4-bromo derivative of this acid, only 2:4-dibromo-5-acetaminothiazole could be isolated.

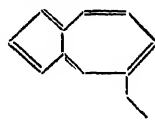
Nitration of 5-acetaminothiazole furnished a product, m.p. 197-98° C., which Prijs, *et al.*<sup>1</sup> consider to be 2:4-dinitro-5-acetaminothiazole, but we find this compound to be only the mono-nitro compound, 4-nitro-5-acetaminothiazole, not only from the analytical figures but also because 5-acetaminothiazole-2-carboxylic acid on nitration furnished 5-acetamino-4-nitrothiazole-2-carboxylic acid, m.p. 155-56° C., which on decarboxylation yielded 5-acetamino-4-nitrothiazole, m.p. 197-98° C. identical with the product obtained above. Fuller details will be published elsewhere shortly.

Dept. of Chemotherapy, K. GANAPATHI.  
Haffkine Institute, Parel, K.-D. KULKARNI.  
Bombay-12,  
September 9, 1952.

1. Prijs, Mengisen, Fallab and Erlenmeyer, *Helv. Chim. Acta.*, 1952, **35**, 187. 2. —, Ostertag and Erlenmeyer *Ibid.*, 1947, **30**, 1200.

## SYNTHESIS OF 5-ETHYL AZULENE

$\beta$ -ACETYL INDANE was prepared<sup>1</sup> by the Friedel-Craft's reaction on indane. Reduction of  $\beta$ -acetyl indane by the modified Clemmensen method<sup>2</sup> using alcohol as miscible solvent gave 5-ethyl indane, b.p. 114-16°/24 mm.,  $n_D^{25}$ , 1.5262.



— 5-ethyl azulene

(Found C, 88.5%; H, 11.7%;  $C_{11}H_{14}$  requires C, 90.4%; H, 9.6%). By reaction with ethyl diazoacetate according to the method of Pfau and Plattner,<sup>3</sup> 5-ethyl indane was converted to an ester, b.p. 145-50°/2 mm. On hydrolysis the ester yielded an acid, b.p. 167-70°/3 mm. which on heating with palladised charcoal (10%) gave a blue distillate from which 5-ethyl azulene (I) has been isolated. It formed a T.N.B. complex which after repeated crystallisations showed a m.p. of 97-97.5°. (Found: C, 59.0; H, 4.3; N, 11.9.  $C_{18}H_{15}N_3O_6$  requires C, 58.5; H, 4.7; N, 11.4%.)

Fuller details of the work will be published elsewhere.

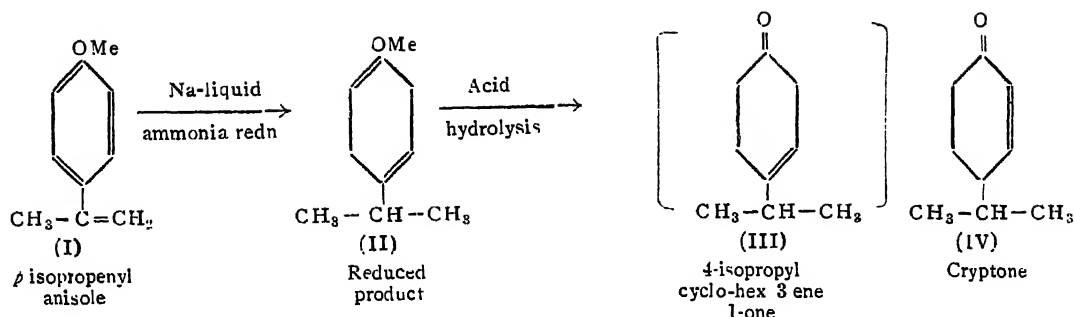
The authors' thanks are due to Dr. B. H. Iyer for his kind interest in this investigation.

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Indian Inst. of Science, M. S. MUTHANNA.  
Bangalore,  
September 24, 1952.

- 1 Julius V. Braun, Georg Kirschbaum and Hans Schuman, *Ber.*, 1920, **53 B**, 1163. 2. Fieser and Seligman, *J. Am. Chem. Soc.*, 1938, **58**, 2482. 3. Alexander St. Pfau and Plattner, *Helv.*, 1939, **22**, 207.

## SYNTHESIS OF CRYPTONE

CRYPTONE (IV), an unusual constituent of certain essential oils,<sup>1,2,3</sup> is an  $\alpha$ : $\beta$ -unsaturated ketone  $C_9H_{14}O$ . Though as early as 1905 it had been prepared by Wallach by the oxidation of  $\beta$ -phellandrene<sup>4</sup> or by the isomerisation<sup>5,6</sup> of terpene-degradation-products like no-pinone and sapina-ketone, no direct synthesis of this



interesting ketone appears to have been attempted up to the present day. As cryptone is very important from the point of biogenesis of essential oil-constituents, and also for building up terpene-molecules like  $\alpha$ -phellandrene, it was thought of interest to synthesise it according to the following scheme:

The reduction of *p*-isopropenyl anisole (I) by sodium and liquid ammonia furnished a liquid (b.p.  $58-9^\circ/2\text{ mm.}$ , yield 48%) and a solid (m.p.,  $188^\circ$ , yield 13%).

The liquid product, on hydrolysis with 10% sulphuric acid followed by treatment with an alcoholic solution of semi-carbazide acetate, gave a semi-carbazone which after three recrystallisations from dilute alcohol was obtained as colourless prismatic crystals, m.p.  $183-85^\circ$  (Found: N, 21.93.  $\text{C}_{10}\text{H}_{17}\text{N}_3\text{O}$  requires N, 22.01 per cent.), m.p. of *dl*-cryptone-semicarbazone is  $183-84^\circ$  (Wallach, *loc. cit.*). The overall yield of the ketone on the basis of the semi-carbazone was about 15 per cent.

The solid appears to be a dimeric compound  $\text{C}_{20}\text{H}_{24}\text{O}_2$  [Found: M.W. (by Rast's method), 300.8; C, 81.15; H, 9.14.  $\text{C}_{20}\text{H}_{24}\text{O}_2$  requires M.W., 296; C, 81.08 and H, 8.1 per cent.]. On reduction (Adam's catalyst in glacial acetic acid) it absorbed six moles of hydrogen and furnished a reduced product, m.p.  $182^\circ$ . On nitration it gave a tetra-nitro-compound, m.p.  $239-40^\circ$  (Found: N, 11.95.  $\text{C}_{20}\text{H}_{24}\text{N}_4\text{O}_{10}$  requires N, 11.72 per cent.).

Further work is in progress.

The author thanks Dr. B. H. Iyer and Dr. Sukh Dev for their keen interest in the work.

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#### EXAMINATION OF THE ROOT BARK OF *TABERNOEMONTANA CRISPA* (DICHOTOMA)

VERY little work seems to be on record on the genus *Tabernæmontana* (Apocynaceae). Greshoff<sup>1</sup> and Ultee<sup>2</sup> have recorded that the milky juice of *T. Spærocarpa*, a species from Java, contained resins, amyris acetate and proteins, while the bark contained 0.5% of an unidentified alkaloid. From *T. coronaria* Br. Ratnagiriswaran and Venkatachalam<sup>3</sup> have isolated two alkaloids, tabernæmontanine,  $\text{C}_{26}\text{H}_{20}\text{O}_3\text{N}_2$ , m.p.  $208-10^\circ$ , and coronarine,  $\text{C}_{44}\text{H}_{56}\text{O}_6\text{N}_4 \cdot 2.5\text{H}_2\text{O}$ , m.p.  $196-98^\circ$  (dec.).

The present report records the results of a preliminary investigation on the chemical constituents of *T. crispa* root bark. The root bark showed the presence of alkaloids and neutral bodies. It has not yet been possible to get the alkaloid in an analytically pure condition.

400 grams of the dried and powdered root bark was exhausted with alcohol. Appreciable quantities of a neutral product separated on cooling and this was removed by filtration. Concentration and chilling gave further quantities of the same product, the total amounting to about 8% on the weight of the bark.

The filtrate was freed from alcohol, treated with water and made acidic to congo red with dilute hydrochloric acid. The resinous insoluble matter was taken up in chloroform and the aqueous layer basified with ammonia. After chilling the yellow precipitate was taken up in chloroform, the extract dried and the solvent removed at a low temperature. The resulting viscous resin solidified to a brittle mass on keeping in a vacuum desiccator, melting at  $85^\circ$ . Yield 12-14 grams, about 3.5% on the weight of the dried root bark.

The neutral material gave a fraction melting at  $192-94^\circ$  on repeated crystallisation from alcohol. It is not affected by bromine in carbon tetrachloride, cold acetone-permanganate and boiling acetic anhydride. It gave negative tests

1. Cahn, Penfold and Simonsen, *J C.S.*, 1931, 1366.
2. Berry, Macbeth and Swanson, *Ibid.*, 1937, 1448.
3. Wienhaus and Striegler, *Schimmel and Co. Reports* 1937, 91
4. Wallach, *Annalen*, 1905, 243, 3. 5. —, *Ibid.*, 1907, 356, 235.
6. —, *Ibid.*, 1908, 359, 270.

with carbonyl reagents. It analyses for the formula  $C_{12}H_{20}O$  (Found C: 79.84, H: 11.01; Calculated: 80.0 and 11.1).

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September 26, 1952.

1. Greshoff, *Ber.*, 1890, 23, 3545. 2. Ultee, *Chem. Weekbl.*, 1916, 13, 183. 3. Ratnagiriswain and Venkatachalam, *Quart. J. Phar. Pharmacol.*, 1939, 12, 174.

#### ON THE OCCURRENCE OF CRANGONIDS (CRUSTACEA, CARIDEA) IN THE COASTAL WATERS OF TRIVANDRUM

THE Crangonids are bottom-dwelling Crustaceans, generally found among sea-weeds in deep waters. Only two species, viz., *Pontophilus hendersoni* Kemp and *P. parvirostris* Kemp have been collected from the Trivandrum Coast at a depth of 15 faths. from a sea bottom formed of mud and shell fragments. The first form is represented by seven specimens including ovigerous females and immature specimens while only a single specimen of the second species has been obtained.

Specimens of *P. hendersoni* collected differ from those recorded by Kemp<sup>1,2</sup> in the following points: (1) The distal lobe of the antennal scale is less acute and its extremity stands below the apex of the spine on its outer margin. (2) The thumb of the sub-chela in the first peræopod is narrower and is about double the length across its base. (3) The fingers of the second peræopod are more than double the length of the palm and their apices are not 'constricted'; a very small tubercle is noticeable at its extremity under high power. (4) The tubercle on the dorsum of the third abdominal somite is visible only as a wavy projection. (5) The specimens from Trivandrum are comparatively large, the ovigerous females measuring 22.5-23 mm., while the largest specimen from the Chilka Lake is only 12 mm. long. (6) Marked difference in colour is also noticed: In the Travancore specimens there are numerous small brown spots and a 'V'-shaped dorsal median mark on the carapace formed by the aggregation of brown pigment spots; the ventral side of the body is whitish.

The affinity of *Pontophilus* Leach and *Philocheras* Stebbing has been discussed by Kemp<sup>1,3</sup> who suggested that *Philocheras megalochir*

Stebbing<sup>4</sup> is closely related to *P. hendersoni* Kemp. The present specimens differ from the type and approach the form described by Stebbing in the nature of the apices of the second peræopod and in the absence of a prominent tubercle on the abdomen.

The single female specimen of *P. parvirostris* Kemp<sup>2,5</sup> obtained is 8.5 mm. long and agrees with the type except that the rostrum is less produced, the thumb of the sub-chela is longer, being about a quarter the length of the hand, the sixth somite of the abdomen is slightly smaller than the telson and the dorso-lateral spinules on the telson are indistinct.

Both *P. hendersoni* and *P. parvirostris* were previously recorded from the East Coast of India, the former one being obtained from Chilka Lake and Orissa Coast from shallow water up to 4½ faths., while the latter was collected from Kilkarai and Waltair. The present record extends the distribution of the species to the West Coast of India also.

The author is grateful to Dr. N. K. Panikkar for his valuable suggestions.

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University of Travancore,  
Kayamkulam,  
August 20, 1952.

1. Kemp, *Mem. Ind. Mus.*, 1915, 5, 261-64, pl. 8, fig. 8, t.-fig. 25. 2. —, *Rec. Ind. Mus.*, 1916, 12, 372-74, pl. 8, fig. 6. 3. —, *Ibid.*, 1911, 6, 5-12. 4. Stebbing, *Ann. S. Afr. Mus.*, 1914, 15, 71-72. 5. Kemp, *Rec. Ind. Mus.*, 1925, 26, 341.

#### A NEW SPECIES OF SYNASCIDIAN FROM MADRAS

IN a former paper<sup>3</sup> the anatomy and larval organisation of a synascidian belonging to the genus *Polyclinum* were described in detail by the author. The outstanding character of this species is the presence of 12 ectodermal ampullæ as a ring surrounding the anterior tip of the larva. According to Berrill<sup>1</sup> there are only 8 ampullæ in *Archidistoma*, *Polyclinum* and *Polysyncrator*, and 4 in other didemnids and polyclinid species. In the present form, the 12 ampullæ are arranged in three rows of four each, one median and two lateral rows. Other ampullæ such as those sometimes found on the outer margin of the lateral rows, or the posteriorly directed vesicles with long narrow tubular 'stalks' and pinnately arranged branches may prove to be of diagnostic value. But, as Van Name<sup>2</sup> states "the true *Polyclinum* are all very closely related to each other, their zooids

apparently having nearly the same structure so that we must depend chiefly on the gross characters of the colony for distinguishing them. The present form is a rectangular and fleshy colony without encrustation of sand, and attached to the substratum by one of the flat surfaces. *P. constellatum* Savigny, described by Herdman<sup>2</sup> as occurring in the Indian Ocean, is very near to the present form in the nature of the ascidiozoid, but differs in certain of its characteristics, viz., an ovate or pyriform colony when young, and umbrella-shaped when fully grown, the area of its attachment being small; and also differs from the present species in the number and rows of stigmata. Whereas *P. constellatum* has the branchial sac with 14 to 18 rows of stigmata, each row with from 18 to 22 stigmata, the present form has a branchial sac with 13 rows of stigmata, each row having 13 stigmata.

In view of these differences this may be treated as a new species, *P. madrasensis*, which may be defined as follows:

*Shape of Colony*: Rectangular and fleshy, attached to the substratum by one of the flat surfaces. *Test*: Soft and gelatinous, with a faint white colour. No encrustation of sand. *Ascidiozoid*: Size from about 5 to 11 mm, arranged in systems. Branchial opening six-lobed, atrial opening smooth. Atrial languet present. *Tentacles*: 30 to 40, of roughly 3 dimensions. *Branchial sac*: Well developed, with 13 rows of stigmata, each row having 13 elliptical stigmata. *Dorsal lamina*: A series of languets. *Abdomen*: U-shaped with unequal limbs, the length below the branchial region being about  $\frac{1}{4}$  the length of branchial sac. *Post-abdomen*: Long and pedunculated, containing gonads and terminal heart. *Larva*: 12 anterior ampullæ arranged in three rows. Posteriorly directed bunches of vesicles present.

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Research Laboratory,  
Chepauk, Madras,  
September 17, 1952.

1. Berrill, N. J., "The *Tunicata*" Ray. Society, London, 1950, No 133. 2. Herdman, W. A., *Jour. Linn. Soc. Zool.*, 1891, 23. 3. Sebastian, V. O., *Jour. Madras University*, 1942, 14, No 2. 4. Van Name, W. G., *Bull. Amer. Mus. Nat. Hist.*, 1945, 44.

# OCCURRENCE OF THE GREEN MUSCARDINE FUNGUS ON *PYRILLA* SP. IN BOMBAY

THE natural occurrence of an entomogenous fungus on leaf hoppers (*Pyrilla* sp.) in the

sugarcane fields on the Deccan Canals in Bombay State evoked considerable interest. Large numbers of nymphs and adults were found to be parasitised by the fungus, thereby indicating the potentialities of the pathogen. The fungus was isolated in pure culture to carry out inoculation studies and establish its identity.

The fungus made very poor growth on potato dextrose agar and other solid media, but made scanty growth with sparse sporulation on a medium containing beef extract. However, when grown on sterilized rice, or rice mixed with an equal part of peanut hulls and incubated at temperatures between 20-24° C. the growth was fairly rapid. The mycelium formed a dense whitish growth on which olive green to olive black spore masses were produced after 10 to 12 days.

Microscopic examination revealed that the fungus was identical with *Metarrhizium anisopliae* (Metsch.) Sorokin. Butler and Bisby<sup>1</sup> record this fungus as having been collected by Rhind in Burma on *Oryctes rhinoceros*. The hyphae are whitish, septate. The conidiophores are penicillately branched and produce conidia in chains. The conidial masses are dry and the columns of conidia are persistent. There is variation in the size of the conidia as indicated by Pope.<sup>3</sup> The spores obtained from colonies on nutrient agar measured  $5.7.5 \times 2.3-3.5 \mu$ , while those from colonies on sterilized rice were  $8-14 \times 3.4-5 \mu$ .

Detailed accounts of this fungus have previously been published by Rorer,<sup>4</sup> Petch<sup>2</sup> and Stevenson.<sup>6</sup> The use of the green muscardine fungus has been studied in detail by Rorer<sup>5</sup> who worked out the practical aspects of employing this fungus in the control of frog hoppers in sugarcane fields in West Indies. Work in this direction has been initiated in Bombay in co-operation with Shri P. V. Wagle, Crop Protection Officer, Sugarcane Research Scheme, Ahmednagar, by employing this fungus for controlling *Pyrilla* sp. in sugarcane fields.

The writers are highly thankful to Dr. M. J. Thirumalachar for help in identifying the fungus.

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Poona-5,  
July 28, 1952.

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G. W. DHANDE.

1. Butler, E. J. and Bisby, G. R., *The Fungi of India*, 1931. 2. Petch, T., *Trans. Brit. Myc. Soc.*, 1931, 16, 55-75. 3. Pope, S., *Mycologia*, 1944, 36, 343-50. 4. Rorer, J. B., *Agr. Soc. Trinidad and Tobago Proc.*, 1910, 10, 467-82. 5. —, *Board of Agric. Trinidad and Tobago, Circular* 8, 1913, p. 10. 6. Stevenson, J. A., *Dept. Agri. Puerto Rico*, 1918, 2, 19-32.

### SEEDLING BLIGHT OF *SESBANIA GRANDIFLORA* PERS.

Soon after the rains in August, 1950, a number of seedlings of *Sesbania grandiflora* Pers. were observed to be dying at Bapatla. The casualties amounted to about 90 per cent. of the seedling stand. Elongated or oblong cankers occurred at the collar region. These were 6 to 10 mm. in length. In a day or two, acervuli of a species of *Colletotrichum* developed on the cankers and the basal part of the stem. The acervuli were black, erumpent, with well-developed stromata and measured 80 to 205  $\mu$  in diameter. The setae were generally at the periphery, dark brown at the base, lighter coloured at the tip, straight or curved, septate and upto 164  $\mu$  in length. The conidia were unicellular, hyaline, falcate and measured  $19.5-30.0 \times 2.7-3.6 \mu$ . The fungus was isolated from germinating spores. On oats agar the mycelium was pale-greyish with abundant aerial hyphae and profuse development of black fructifications.

Seeds of *Sesbania grandiflora* were inoculated by steeping them in a suspension of the spores, and sown in sterilised soil. Twelve out of twenty seedlings died within three days of germination developing typical lesions and later, the fructifications of the fungus. The seedlings in the controls were all unaffected. In another experiment seedlings of *Sesbania* were inoculated by spraying a suspension of spores on the cotyledons and placed under a bell jar for 24 hours. Ten out of twelve seedlings developed water-soaked lesions on the cotyledons in five days. Within three more days the lesions extended to the hypocotyl and the seedlings were killed. Acervuli developed in profusion all over the hypocotyl and the cotyledons of the seedlings. The controls were free.

Comparison of the isolate with *Colletotrichum capsici* (Syd.) Butler and Bisby showed close morphological resemblance. Twelve fruits of *Capsicum annum* L. were inoculated with each of the isolates—the one from *Sesbania* and *C. capsici* isolated from *Capsicum* fruits. Suitable controls were kept. While all the fruits inoculated with the *Capsicum* isolate rotted within three days with profuse development of acervuli, only five of those inoculated with the *Sesbania* isolate developed small, water-soaked or brown, circular lesions in six days. Very few acervuli developed. The fungus was re-isolated in each case.

The culture obtained from *Sesbania* was maintained on sterilized *Capsicum* fruits for five generations and then inoculated on healthy green *Capsicum* fruits. There was rapid rotting

in ten out of twelve fruits with typical lesions. There was little difference from the rot caused by the *Capsicum* isolate. Conversely while the *Capsicum* isolate did not produce any symptoms on *Sesbania* seedlings immediately on isolation, after having been maintained on sterilized *Sesbania* stems for five generations, it caused the typical seedling blight in six out of twelve seedlings inoculated, while the *Sesbania* isolate infected eight out of twelve.

Ramakrishnan<sup>1</sup> has found that the parasitism of *C. capsici* is influenced by the substratum on which it has grown for a protracted period. The fungus under study exhibited a similar behaviour. Since morphologically it closely resembles *C. capsici* and is capable of infecting *Capsicum* fruits also causing typical symptoms, it is considered to be identical with *Colletotrichum capsici* (Syd.) Butler and Bisby.

I am grateful to Mr. T. S. Ramakrishnan, Government Mycologist, Coimbatore, for critically going through this note.

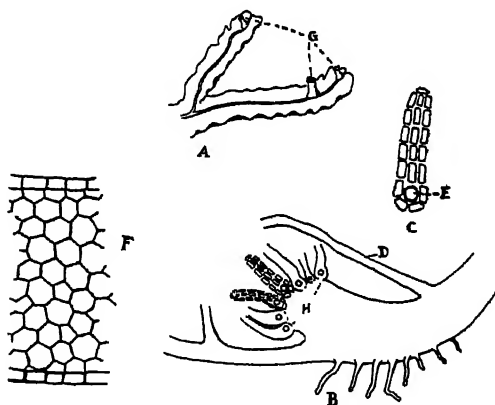
Ootacamund,  
July 3, 1952.

K. V. SRINIVASAN.

1. Ramakrishnan, T. S., *Proc. Ind. Acad. Sci.*, 1947, 25, 15-27.

### NOTES ON INDIAN HEPATICS

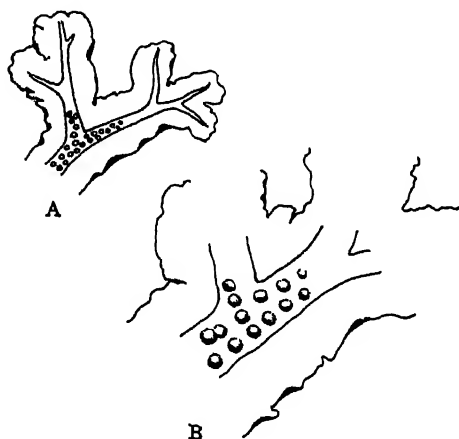
In the course of identification of the Liverworts collected by the author from Kathmandu, Nepal, in September 1951, it was found that the collection contained a material with the following notable characters:



A. Habit. B. L. S. Of Female thallus showing the position of Archegonia. C. An Archegonium enlarged. D. Involute. E. Egg. F. T. S. Thallus. G. Involute. H. Archegonia, in clusters.

Dieocious, thallus thin in large patches, robust, medium to largish in size, green to reddish

brown, elongate sparingly dichotomously branched with linear segments of more equal breadth, mid-rib broad, conspicuous 10-12 cells thick, margin more undulate and one-celled. Internal cells wider than epidermal cells, 5-7 angled. Radiculose, rhizoids smooth-walled, numerous, scales absent. Involucres antical in acropetalous succession vertically directed upward, 2 mm., tubular forming a complete ring, cylindrical, mouth truncate, minutely crenate. Archegonia in cluster, upto 20 in number occurring in all stages. In all the material examined, ripe sporogonia were not found. The male fronds smaller than the female ones and less robust than the latter, 1.5 cm. to 2 cm. long by 1 cm. to 2.4 cm. broad. Apex bifid and slightly notched. Antheridia numerous, globose immersed in broad mid-rib in 2 to 3 rows.



A. Habit; Male thallus showing the position of antheridia. B. A portion of the same thallus enlarged.

Thus the material resembles *Pellia neesiana* (Gottsche) Limpr. described by Macvicar,<sup>3</sup> as quoted by Kashyap<sup>2</sup> and also that by Pearson.<sup>1</sup> It has an additional feature—that of possessing involucres in acropetalous succession.

This is the first record of its occurrence from Nepal.

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February 28, 1952.

JWALA PRASAD SINHA.

1. Kashyap S. R., *Liverworts of the Western Himalayas and the Punjab Plains*, University of Punjab, Lahore, 1932. 2. Pearson, W. H., *The Hepaticae of the British Isles*, London, 1902. 3. Macvicar, *Students Hand Book of British Hepaticae*, 1926

# NOTES ON TWO SYNCHYTRIUM SPECIES

A *Synchytrium* species parasitizing the leaves of *Millingtonia hortensis* Linn. f. and inciting the formation of tiny galls was collected near Bangalore. The galls were hypophyllous, slightly raised above the leaf surface as crateriform nodules (Figs. 1 & 2), greenish-yellow at the beginning and later turning dark brown in colour.

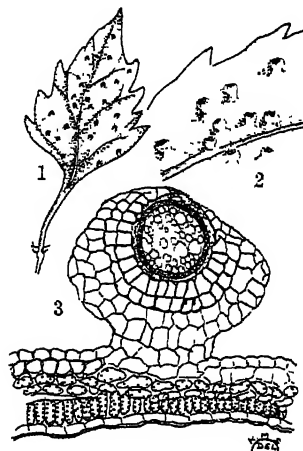


FIG. 1. Infected leaflet of *Millingtonia hortensis*,  $\times \frac{1}{2}$ . FIG. 2. Enlarged view of the galls,  $\times 2\frac{1}{2}$ . FIG. 3. Section through the gall showing the resting spore,  $\times 100$ .

Sections through the galls reveal the resting spores lodged inside the galls. No prosorus or sporangial formation has been observed. The sorus is entirely epidermal in origin, but due to the overgrowing of the surrounding host cells, a cylindric gall 200-350  $\mu$  broad and 200-270  $\mu$  high, projecting above the epidermal layer is formed. At the level of the epidermis the gall is slightly constricted. There is a single resting spore in each gall. The host cells of the gall lining the resting spore on the sides and at the base are large and isodiametric. The layers of cells above the resting spore are small and thin-walled and collapse at maturity thereby releasing the resting spore. On the sides of the gall there are 3 to 4 layers of cells surrounding the resting spore (Fig. 3).

Mature resting spores are yellowish-brown, subglobose to spherical, 90-140  $\mu$  in diameter, thick-walled (wall up to 6  $\mu$  thick), and smooth (Fig. 3). Comparative studies with other *Synchytrium* species so far described indicate the present species is undescribed. The name *Synchytrium millingtonicolum* is proposed for its accommodation.

*Synchytrium millingtonicolum* sp. nov.

Galls on leaves, hypophyllous, simple, appearing as small crateriform tubercles. Resting

spores subglobose or spherical, yellowish-brown, 90-140  $\mu$  in diameter, wall 6  $\mu$  thick, smooth. Hab. on the leaves of *Millingtonia hortensis* Linn. f. Bangalore, leg. K. M. Safeeulla, 10-7-1952.

In a recent paper Gupta and Sinha<sup>1</sup> reported a *Synchytrium* on the leaves of *Phaseolus radiatus* L. as an undescribed species with the name *S. phaseoli-radiati* Sinha and Gupta. The galls were stated to be simple or compound, with the resting spores measuring 165-200  $\mu$  in diameter. In determining the identity of the species, the authors compared it with *S. phaseoli* Patel, et al., and found their species to be different. They, however, overlooked the fact that *Synchytrium ajrekari* Payak and Thirumalachar has already been reported on *Phaseolus mungo* by Payak<sup>2</sup> which has the same characters and is identical with the species reported by Gupta and Sinha. Consequently, *S. phaseoli-radiati* should be treated as a synonym of *S. ajrekari*.

In conclusion the writers wish to acknowledge their indebtedness to Dr. L. N. Rao for valuable suggestions and kind encouragement.

Central College,

K. M. SAFEEULLA.

Bangalore, and

Agricultural College,

H. C. GOVINDU.

Hebbal, Bangalore-6.

August 26, 1952.

1. Gupta, S. C. and Sinha S. *Indian Phytopathology*, 1951, 4, 7-9. 2. Payak. M. N., *Curr. Sci.*, 1951, 20, 103-04

#### NEW HOST FOR *XANTHOMONAS MALVACEARUM* (SMITH) DOWSON

BLACK arm of cotton caused by *Xanthomonas malvacearum* (Smith) Dowson, is observed to be on the increase in this State. This disease is seed-borne but the pathogen also survives in the infected plant debris left in the soil. Consequently, secondary infection is possible from the latter source. It was suspected that the organism may be capable of parasitising other host plants also. Patel and Kulkarni<sup>3</sup> have found out that this organism failed to infect seven different hosts belonging to *Malvaceae*. Brown and Gibson<sup>1</sup> have, however, found that *Thurberia thesepesioides* A. Gray can serve as a host for this bacterium in Arizona. Palm<sup>2</sup>

has described a disease of *Eriodendron anfractuosum*, DC. caused by the same bacterium from Illinois.

In order to find out whether any of the common plants growing in the neighbourhood of the cotton fields serve as collateral hosts for this bacterium, inoculations were carried out with pure cultures of the organism on several plants belonging to *Malvaceae* and *Euphorbiaceae* and *Aristolochia bracteata* Retz. The suspension of the bacteria was smeared on both the surfaces of the leaves previously punctured by very fine sterilised pins and the plants were kept inside glass cages. Suitable controls were kept. Small water-soaked spots developed on the leaves of *Jatropha curcas* L. in 4 to 6 days. The spots increased in size upto 3 cm. across and ultimately turned brown. The midrib was also infected and this led to the shrivelling and drying of the distal portions of the leaf-blade. The controls were healthy.

The bacterium was reisolated from the infected portions of *J. curcas*. When these reisolates were inoculated on *Gossypium hirsutum* L. (Co. 2), typical angular leaf-spots were developed in the course of 10 to 12 days. From the above it is clear that *J. curcas* serves as collateral host for this organism. Inoculations under similar conditions on *Abutilon indicum* G. Don., *Aristolochia bracteata*, *Hibiscus rosasinensis* L., *H. ficulneus* L., *H. micranthus* L., *Pavonia zeylanica* Cav., *Sida cordifolia* L., *Cryptostegia grandiflora* R. Br., *Jatropha glandulifera* Roxb. and *J. gossypifolia* L. did not produce any symptom of the disease.

I am grateful to Sri. T. S. Ramakrishnan, Government Mycologist, for his valuable guidance and help in carrying out these experiments.

Division of Mycology,

N. V. SUNDARAM.

Dept. of Agriculture,

(Govt. of Madras),

Lawley Road P.O.,

Coimbatore,

October 1, 1952.

1. Brown, J. G. and Gilson, F., *Phytopathology*, 1923, 13 (10), 455-57. 2. Palm, B. T., *Ibid.*, 1932, 22 (10) 867-68. 3. Patel and Kulkarni, *Indian Phytopathology*, 1951, 3 (1), 51-63. 4. Smith, E. F., "An Introduction to Bacterial Disease of Plants," W. F. Saunders, Cy., Philadelphia.



## REVIEWS

**Trigonometry, Plane and Spherical.** By Lloyd L. Smail. (McGraw-Hill Book Co.), 1952. Pp. 406. Price \$ 3.75.

The first eleven chapters give a very good and rigorous treatment of elementary plane trigonometry. By introducing rectangular and polar co-ordinates, trigonometric functions are defined for any angle, and their signs discussed. The definitions are accurate and the proofs are rigorous and refreshing. An adequate number of problems of varied type and difficulty will be found in the book, and due emphasis is laid on numerical computation work. The subject-matter extends up to De Moivre's theorem and Euler's formulæ for the circular functions.

The arrangement of the subject-matter differs considerably from that usually found. Thus the relation between the sine and the cosine of an angle is taken up in as late as the fourth chapter, on p. 95, while problems on heights and distances including three-dimensional problems are considered in Chapter 2. This will not work out as a handicap in the hands of the teacher who uses his discretion to rearrange the subject-matter in his own way, if he chooses. Under the prevailing Indian conditions, the cost of the book will preclude its being widely used as a text-book. But the student and the teacher who can afford to use it will be amply rewarded by the accurate and rigorous treatment of the subject presented in the book.

Two chapters on the solutions of right and oblique spherical triangles, though brief and well-written, serve little purpose for our Intermediate syllabuses. The book concludes with a chapter on logarithms, and five-figure tables of logarithms, trigonometric functions, etc.

C. N. S.

**Elements of Physico-Chemical Calculations for Students of Science and Pharmacy.** By M. L. Schroff. (Pindars Ltd., 7, Lower Rawdon Street, Calcutta 20), 1952. Pp. 242. Price Rs. 12-8-0.

The volume under review is the second edition of the book first published twelve years ago. It is too elementary to be of use to any science students beyond the Intermediate stage. While the subject-matter of each chapter is presented in clear language, most of the information can be had from much less expensive pub-

lications. Chapter IV has a misleading title which makes a reader expect problems outside the narrow part of the subject actually covered. The chapter on Indicators in Acidimetry and Alkalimetry also shows the limitation of the volume with statements like the following: "A normal solution of  $\text{Na}_2\text{CO}_3$  will contain one molecule of  $\text{Na}_2\text{CO}_3$  if the solution is to be titrated using phenolphthalein." The distribution of material and the space devoted to each topic suggests that the volume may be of use to students of pharmaceutical chemistry.

S. V. A.

**Polarography. Vol. I.** By I. M. Kolthoff and James J. Lingane. (Completely revised and augmented edition.) (Interscience Publishers, New York, London), 1952. Pp 420. Price \$ 9.00

The second edition of this invaluable book appears eleven years after the first edition. The revision has kept pace with the very rapid progress in the field of polarography, resulting in two volumes (instead of one in the first edition), wider in scope and with many new illustrations of great interest. Most of the chapters have been rewritten and several new chapters have been added. Many of the illustrative data are taken from the original communications from the authors' laboratories.

The book under review consists of two parts, the first (15 chapters) dealing with the theoretical principles, and the second (14 chapters) with instrumentation and technique. In Part I, the fundamental theory of the diffusion current is treated on the lines developed by Ilkovic, MacGillavry and Rideal. The treatment of Lingane and Loveridge for modified Ilkovic equation correcting for the sphericity of drops is a valuable addition to this chapter. The various factors that affect the value of the diffusion current are critically examined. Separate chapters have been devoted to deal with the migration current, electrocapillary curve of mercury, residual current, maxima, polarographic behaviour of simple and complex metal ions. Thermodynamic significance of half-wave potential is given in great detail. The application of various formulations is shown with numerous illustrations making it easy even for the beginner to apply these formulations to his systems. The

authors rightly stress the inadequacy of the present knowledge regarding the phenomenon of maxima. The recent contributions (1951) of Hans and Stackelberg could have been referred to in this connection. The complicated question of hydrogen discharge is clearly reviewed. Chapters V, VI and XV are a valuable addition to this Part. In Chapter V, the authors summarize the general characteristics of non-aqueous media in polarography, with reference to methyl and ethyl alcohols, ethylene glycol, glacial acetic acid, liquid ammonia, and molten salts. In Chapter VI, some unusual phenomena in diffusion current like interfering electrode reactions, the water current, the hydrolysis current, compensating anodic-cathodic diffusion current are discussed. The effect of reaction rates on polarographic waves described in Chapter XV is very interesting. The contribution on the catalyzed hydrogen peroxide waves indeed opens up a new field of investigation.

In Part II, the authors explain the various circuits used in polarography. Chapter XVIII is a new addition and contains a summary of various experimental factors which are of significance in practical polarography. This is an addition, especially useful for beginners.

In dealing with the theoretical revision of the Ilkovic equation, the derivations of Strehlow and Stackelberg and Kambara and Tachi could have been added. In the reviewer's opinion, the Breyer-Gutmann technique and a critical review of the development of A.C. Polarography would have been very welcome. The addition of an index (to both the volumes) would also have greatly facilitated easy reference. The book is perhaps priced a little too high. The presentation, coming as it does from those who have contributed substantially to the progress of this branch of analytical chemistry, is as masterly as any would desire.

M. R. A.

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**Medicinal Chemistry, Vol. I.** By Alfred Burger. (Interscience Publishers, Inc., New York, and Interscience Publishers, Ltd., London), 1951. Pp. xviii + 577. Price \$10.0.

This is a borderland subject, an understanding of which requires a close acquaintance with the different branches of chemistry and biology in addition to specialised knowledge in one branch. Nevertheless, Alfred Burger has made a successful attempt in the book under review to present a connected story of the chemistry, biochemistry, therapeutic and pharmacological action of natural and synthetic drugs.

Out of the 28 chapters in this volume, the first six deal with general topics like (1) Introduction, (2) Historical Development of Medicinal Chemistry, (3) Relation of Chemical Structure and Biological Activity, (4) Physical Properties and Biological Activity, (5) Biological Study of Drugs, and (6) Restricted Response of Cells to Drugs. The remaining 22 chapters deal with drugs arranged according to their usage.

The table in the chapter on historical development, listing some important dates in the development of medicinal chemistry during the last 100 years, serves as a reckoner of the strides made by medicinal chemistry. In the chapter on relation of structure to activity, the relation in homologous series and also the effect of the functional groups are described. Theories of isosterism, physical properties of isosteres, their reactivity, classification and biological activity are discussed in the chapter on physical properties and biological activity. In the chapters dealing with the different classes of drugs, in addition to a description of the chemistry of the drugs, attempts have been made wherever possible to describe theories of action as well as tests and methods of application.

The material presented here has been extensively documented. However, in the opinion of the reviewer, inclusion of an exhaustive bibliography at the end of each chapter would have enhanced the usefulness of the publication to the research worker to whom this book will be very helpful.

The publication is bound to be very well received by all those interested in medicinal chemistry.

B. H. IYER.

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**Medicinal Chemistry, Vol. II.** By Prof. Alfred Berger. (Interscience Publishers, New York and London), 1951. Price \$10.

The second volume of this treatise of medicinal chemistry deals mainly with the chemotherapeutic agents for bacterial, protozoal, fungal and viral infections, except for a chapter on the chemistry and medicinal uses of hormones. The theories of metabolite antagonism, dyestuffs in chemotherapy, the sulphanamides, the anti-malarials, chemotherapy of acid-fast infections, the antibiotics and a few other chemotherapeutic agents are the fields of study covered in this volume.

In a book covering such varied groups of subjects, it is almost impossible to review completely the vast field of recent discoveries of

new drugs, their chemistry, action and uses. This ambitious attempt in surveying and co-ordinating the researches in the chemistry, biochemistry, therapeutics and pharmacological actions of both synthetic and natural drugs has unfortunately led to the superficial survey of many aspects of the problems discussed. But, providing as it does, a sufficient number of important references, the volume serves the purpose of an able guide, and should form an useful companion to all research workers in medicinal chemistry.

M. SIRSI.

#### Chemical Physiology of Endo-parasitic Animals.

By Theodor von Brand. (Academic Press Inc, 125 East, 23rd Street, New York), 1952. Pp. x + 339. Price \$ 7.50.

This is the first book of its kind published on the physiological aspects of parasitology. The purpose of the book, as has been stated by the author in the preface, "is to review and integrate the relevant literature which, because scattered in many periodicals and contained, relatively often, in papers dealing primarily with non-physiological topics, is sometimes difficult to locate". This has been more than achieved by the author. The subject-matter is explained lucidly and every statement made is supported by proper authority. The author has published many papers on the subject and is himself an authority in the field.

The book is divided into three parts. Part I deals with the chemical composition of parasites and has a chapter each on the following subjects: (1) Dry Matter and Inorganic Substances, (2) Carbohydrates, (3) Lipids, (4) Proteins, (5) Physiologically active substances such as vitamins, etc., (6) Pigments, (7) Toxic Substances. The chemical composition of the parasites, published so far, is given in tabular form and discussed.

Part II is on the Metabolism of Parasites and includes chapters on the metabolism of (1) Water, (2) Inorganic Substances such as Phosphorus, Chlorides, etc., (3) Carbohydrates, (4) Lipids, (5) Proteins, and (6) Gaseous Exchanges, (7) Oxygen Relationships, (8) Growth Requirements. The last chapter contains most of the work so far attempted for culturing parasites outside the body of the host. At the bottom of page 199, it is stated that the "report of Lamy (1948) that *E. invadens* could be cultivated in the presence of small pieces of organs, but in the absence of bacteria or bacterial extracts, requires confirmation". The paper by M. J. Miller in the *Canadian J. of*

*Comp. Med.* of November 1951, confirming the findings of Lamy was, perhaps, not in the hands of the author at the time of the preparation of the book.

Part III deals with the chemical host-parasite relationship and has chapters on (1) Nutritional Relationships Between Parasites and Hosts, (2) Physiological Basis and Metabolic Consequences of Parasitic Anæmias, (3) Metabolic Disturbances in Parasitic Infections, (4) Endocrinological Relationships, and (5) Chemotherapy from a Physiological Point of View. The last chapter gives a rational explanation of the action of certain antiprotozoal and antihelminthic drugs and the problem of drug resistance is also discussed.

A complete bibliography is given at the end of each chapter, which makes it a very useful reference book. A chapter could have been included on the immunological and serological aspects of parasitic infections. The reviewer, however, feels sure that all those interested in the subject will be thankful to the author for bringing together the available literature in one compact book with lucid explanations wherever needed.

N. S. K. RAO

*Man in Evolution.* By M. R. Sahni. (Orient Longman Ltd., Bombay, Calcutta and Madras). Pp. 10 + 272. Text-Figs. 116. Map 1. Price Rs. 8-12-0.

The great merit of Sahni's *Man in Evolution*, a charming little book, lies in the fact that it leads to a synthesis and meaningful interpretation of many scattered taxonomic, biological, geological, climatological and geographical data. Such a work should help to encourage collaboration between sciences, such as biology, geology, anthropology, geography and meteorology. This book is equally useful for archaeologists and pre-historians. Though the book has been primarily written for 'young students of science, particularly those aspiring to their Bachelor's Degree in Geology, Anthropology or Zoology', it has a much wider interest and even mature scientists in any branch of the above-mentioned sciences will find it useful as a reference book, when dealing with borderline problems.

Like many other palaeontologists, the author finds a key to the organic evolution from the simplest organism to man in the geological changes and climatic fluctuations on the earth on the one hand and the quality of adaptiveness on the part of the organisms concerned in

the process of evolution on the other. For instance, on page 77, he says: "This struggle for survival in a changed environment carried on by means of adaptation is believed to be the main factor in evolution. It results in the appearance of new species." In fact, the author has throughout the work established a chain of cause and effect phenomena. He has repeatedly shown that specialization leads to the extinction of a race while generalised organisms, with greater powers of adaptability, have through the ages provided the materials which led to further and further advances.

The book is written throughout in an easy style so that the information contained in it becomes readily assimilable. The scientific data are well regimented so that they are easily comprehensible to a science student of average intellect.

Though the reviewer is not in a position to examine very critically the innumerable data presented in the book and the observations recorded thereon, he feels that the zoological portion of the book could be improved considerably.

An alphabetical, and not an analytical, bibliography, covering 8 pages of small type, is given at the end. Though choppy of the text has been avoided by not quoting references in the text, it would have been helpful for students if a list of references had been given at the end of each chapter or the bibliography had been divided into subject-sections.

The get-up of the book is very pleasing and the cover decorative. The gifted family of Sahni, for Mrs. Sahni and Miss Kamini Sahni have helped the author in many ways, deserve the gratitude of science students. The publishers, Messrs. Orient Longmans Limited, are to be congratulated on bringing out a book of this high standard at a low price of Rs. 8-12-0.

S. L. H.

**Five-Membered Heterocyclic Compounds with Nitrogen and Sulphur or Nitrogen, Sulphur and Oxygen (Except Thiazole).** By L. L. Bambas, Parke, Davis and Company. (Interscience Publishers, Inc., New York), 1952. Pp. 403. Price \$14.00.

The fourth volume of the series of monographs on the chemistry of heterocyclic compounds, edited by Dr. A. Weissberger of the Eastman Kodak Company, maintains the standard of thoroughness and scholarship set by the previous volumes in the series. The scope of the book is slightly wider than the title, the selenium analogues of the sulphur

compounds also being included. Except that the literature after 1948 has not been covered, the treatment is comprehensive, and since a relatively circumscribed field has been chosen it has been possible to list nearly every known compound of the specified types. Chemical Abstracts and Ring Index systems of nomenclature have been used, and the chemical names have been supplemented by clearly printed structural formulæ. Of special interest is Table VI which lists "controvertible (questionable?) names and structures of some 1:2:4-thiadiazoles occurring in the literature".

The three parts into which the book is divided deal with (I) thiadiazoles and selenium analogues; (II) five-membered rings containing, N, S, Se or O in addition to one S and one N; and (III) isothiazoles and selenium analogues. Each part is subdivided into small sections covering closely related classes of compounds. The historical development of the chemistry of each class is followed by a tabular survey of individual compounds, their structures, methods of preparation, physical properties and references to the literature. In some of the sections the historical account is followed by a somewhat scrappy discussion, the theoretical aspects of which are superficial. Thus it is surely inadequate to limit the consideration of the alleged similarity of the thiadiazole and thiophene ring systems to the arithmetical requirement for a "sextet" of electrons. The comparison of 1:2-benzisothiazoles and naphthalene made by Fries in 1927 is cited, but the inclusion of isoquinoline and a more fundamental approach to this subject would have been profitable. Further, isolation of the "discussion" of the chemistry of a given class of compound from the main presentation is of doubtful advantage. From this and other points of view the book under review is not easy reading. Numerous compounds and a mass of data have been assembled systematically and in the briefest possible space; the result is a valuable book of reference, but not a readable treatise which seeks to give an overall picture of a field of heterocyclic chemistry.

Naphthasultam and many of its derivatives are mentioned together with the relevant patents, but an omission is a reference to BIOS 987, in which the preparation of naphthasultam and from it a vat dye (Indanthrene Yellow 6GD) is described. Some of the formulæ in p. 232, 264, 327 need to be corrected.

Although the paper, printing and binding are superb, the price seems excessive for a volume of 403 pages,

K. V.

**Snakes (in Tamil).** By M. Ekambaranadhan. (M. Swaminathan, Gopalapuram, Madras 6), 1952. Pp. vi + 40. Price Re. 1.

This small book deals with the life and habits of the Indian snakes in general for the benefit of laymen and students of the primary and secondary schools.

There are 35 illustrations and a frontispiece photograph. Throughout the book the author has taken special pains to disprove many popular beliefs and superstitions commonly associated with snakes in India. The style is very lucid and the book provides laymen and school students ample opportunities to learn something about snakes. The author deserves praise for bringing out a very informative book at such a low cost of Re. 1 only. His forthcoming books as announced in the cover page, should also prove to be of immense use in popularising zoology and harnessing it for the benefit of the public.

K. C. J.

#### Books Received

**A Hand Book of Shellac Analysis**, 2nd Edition. By M. Rangaswamy and H. K. Sen. (Indian Lac Research Institute, India), 1952. Pp. 144. Price not given.

**Advanced Statistical Methods in Biometric Research.** By C. Radhakrishna Rao. (John Wiley & Sons, New York; and Chapman & Hall, London), 1952. Pp. xvii + 390. Price not given.

**Biologie D'Anopheles Gambiae.** By M. H. Holstein (Organisation Mondiale D'Eha Sante, Geneve), 1952. Pp. 176. Price 10 sh.

**Television.** By F. Kerkhof and W. Werner. (Phillips Technological Library), 1952. Pp. 432. Price not given.

**Metallurgical Equilibrium Diagrams.** By Hume-Rothery, J. W. Christian and W. B. Pearson. (Institute of Physics), 1952. Pp. 305. Price 50 sh.

**Molecular Architecture of Plant Cell Walls.** By R. D. Preston. (Chapman & Hall), 1952. Pp. 211. Price not given.

**Vacuum Technique.** By Arnold L. Reiman. (Chapman & Hall), 1952. Pp. ix + 432. Price 18 sh.

**Physiological Approach to the Lower Animals.** By T. A. Ramsay. (Cambridge University Press), Pp. v + 148. Price 15 sh. net.

**Rocket Propulsion.** By Eric Burgess. (Chapman & Hall), 1952. Pp. 229. Price 21 sh. net.

**Annual Review of Biochemistry.** (Annual Reviews Inc., Stanford), 1952. Vol. 21. Pp. 781. Price \$ 6.

## SCIENCE NOTES AND NEWS

### Chemical Control of *Orobanche* on Tobacco

Sri. N. Prasad, Plant Pathology Section, Agricultural Institute, Anand, writes as follows: Recently King, Lambrech and Finn<sup>1</sup> reported on the herbicidal properties of a new chemical, 2, 4-dichlorophenoxyethyl sulphate, while working on tomato, asparagus and sweet corn. They found that this chemical could check weeds in any of the above-mentioned crops without causing any apparent injury to either of them. This chemical known commercially as Crag Herbicide I is produced by the Union Carbide and Carbon Corporation of New York.

From our experiments, it appears that in 2, 4-dichlorophenoxyethyl sulphate, we have a chemical which is selective in action so far as *Orobanche* is concerned but not affecting tobacco and it may be thus useful in controlling this important plant parasite of tobacco.

\* King, Lawrence, J. Lambrech J. A. and Thomas, P. Finn, *Contrib. Boyce-Thompson Inst.*, 16 191-208.

### International Cancer Research Conference, Bombay

Meetings of the International Cancer Research Commission will be held in Bombay from 30th December 1952 to 2nd January 1953. Dr. V. R. Khanolkar, Director, Indian Cancer Research Centre, Bombay, and President of the International Cancer Research Commission is organising two symposia on (1) Geographical Pathology of Cancer in Asia, and (2) Chemotherapy of Cancer, to be convened during the session of the Commission in Bombay. Medical men and scientific workers interested in these symposia are cordially invited to attend. Further details will be announced later.

### International Electrotechnical Commission

India has, for the first time, been elected member of the Committee of Action of the International Electro-Technical Commission (IEC) for a 9-year term along with Norway and Netherlands succeeding France, Sweden

and Switzerland. The national responsibility for the IEC work is now borne by the Indian Standards Institution (ISI) and the Indian National Committee (INC-IEC) has Shri S. A. Gadkari of the Central Water and Power Commission as its President.

#### Essay Contest

An essay contest has been announced by the Indian Dairy Science Association, the subject of the essay being "Production and Marketing of Ghee in India". The last date for submitting the essay is 31st January, 1953. Any other information required can be obtained from The Hon'y. Secretaries, Indian Dairy Science Association, Hosur Road, Bangalore-1.

#### Award of Research Degree

The University of Nagpur has awarded the Degree of Doctor of Philosophy in Zoology to Mr. K. K. Tiwari for his thesis on "The Indo-Burmese Fresh Water Prawns of the Genus *Palæmon*".

#### Power Sources in Arid Zones

Plans for developing sources of power in arid zones through wind and solar energy are being discussed by UNESCO's Advisory Committee on Arid Zone Research. The Committee will also consider the setting up of an Arid Zone Development Centre.

UNESCO's aims in this field are to discover and make available the experience and expert knowledge gained from the experiments and projects carried out in many parts of the world and to help the creation and extension of research stations for the study of Arid Zone problems. (UNESCO.)

#### Central Bureau of Education

Organised as a service agency through which the Ministry can be of assistance to the States as well as to educationists and educational institutions, the Central Bureau of Education consists of six sections dealing with Publication, Information, Statistics, Audio-Visual Aids, the Central Education Library and the Central Secretariat Library. The publication work of the Bureau includes research and compilation, preparation and printing of pamphlets, exchange of Bureau's publications with outside agencies and distribution within India of gift-books received from abroad.

#### Shellac-Coated Earthenwares

The application of lac to non-porous surfaces such as those of earthenwares has been made possible as a result of investigations at the Lac Research Institute, Ranchi, Bihar. A film of shellac on earthenware resists the action of water, soap solution (hot and cold), salt, mineral and vegetable oils as also of dilute mineral and organic acids. Such coated vessels can conveniently replace costlier materials such as porcelain or glazed earthenware or glass, for storing articles of every-day use like common salt, molasses, oils, pickles, etc. Lac being non-poisonous, no harmful effect would result from its use. Another important application of lac-coated pots has been found in their use for collecting and storing palm juice from palm trees. The sealing action of the lac film prevents the fermenting enzymes from getting lodged in the pores of the vessel; this prevents or slows down fermentation processes. With usual precautions these vessels could be used repeatedly.

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#### IMPORTANT NOTICE

In view of the transfer of the Editor to Madras, it is requested that all articles, letters, reviews, books for review, exchange journals, corrected proofs and other items intended for publication in CURRENT SCIENCE may kindly be addressed to:

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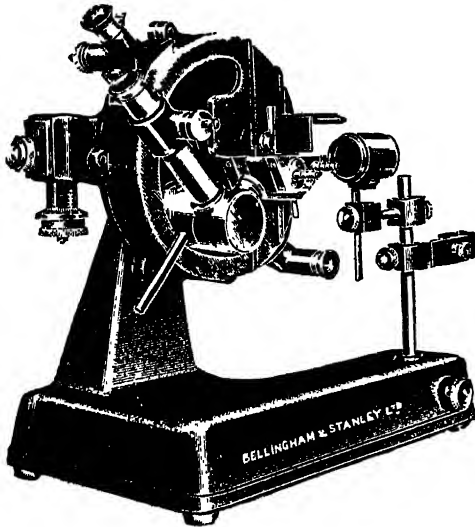
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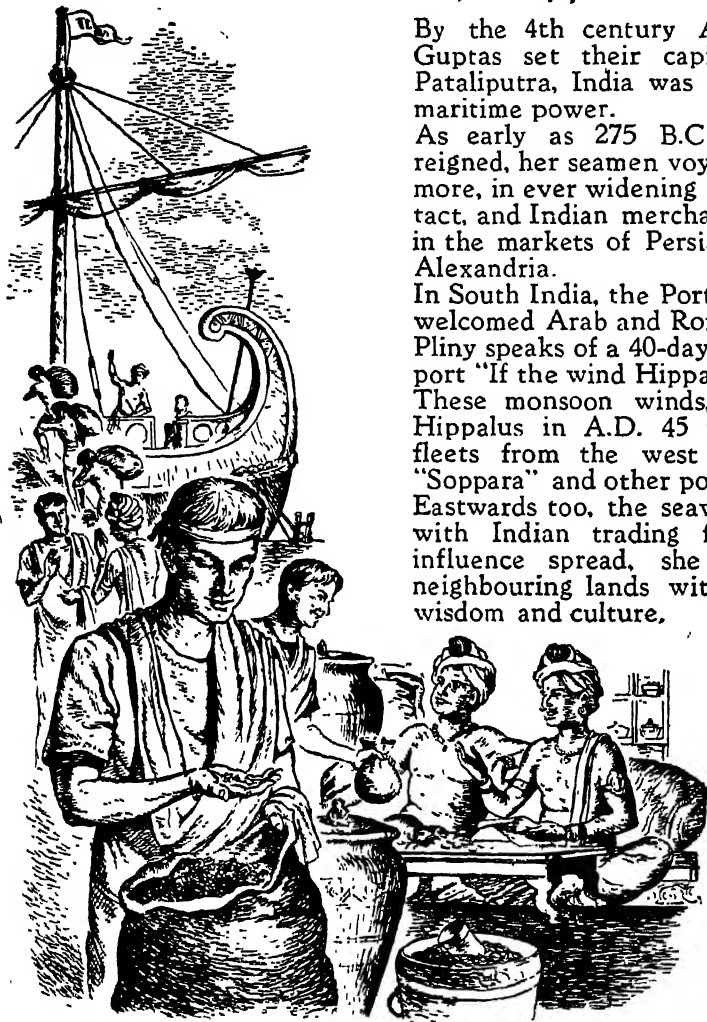
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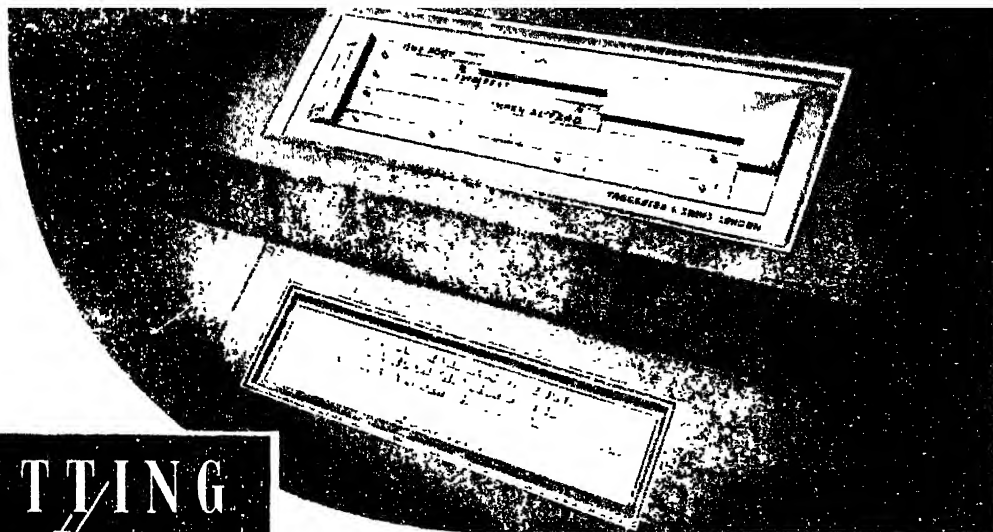


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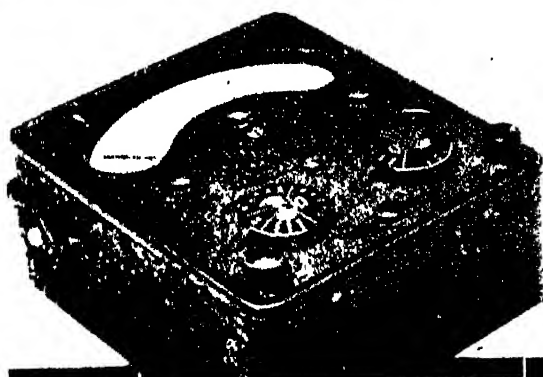
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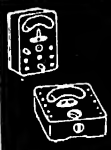


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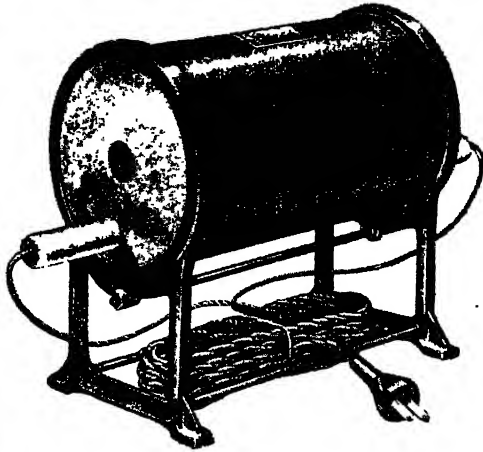
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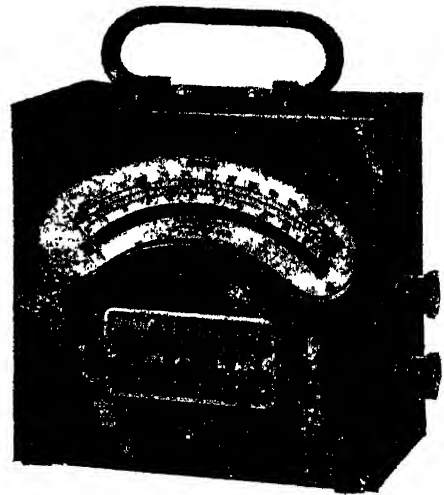
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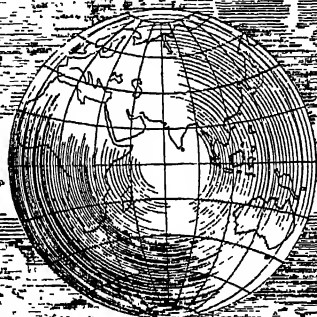
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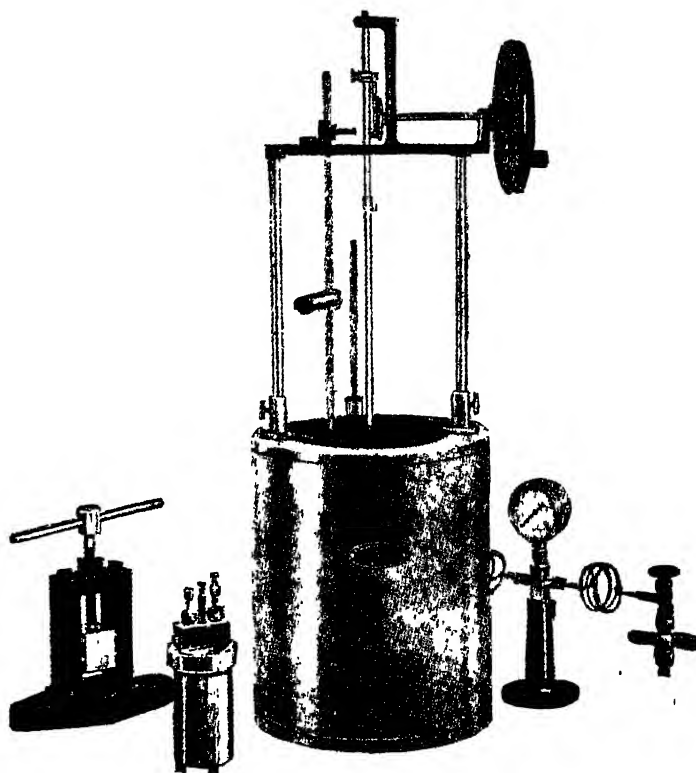
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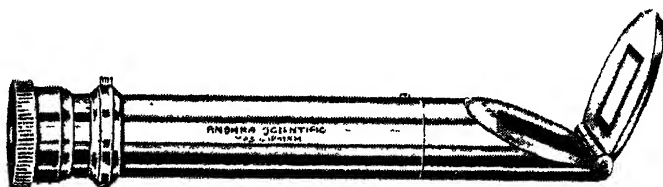
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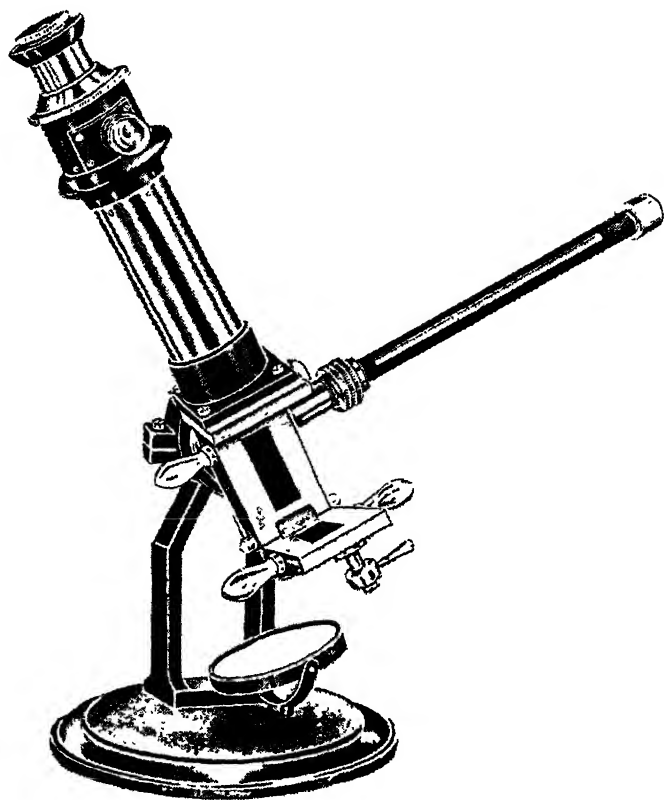
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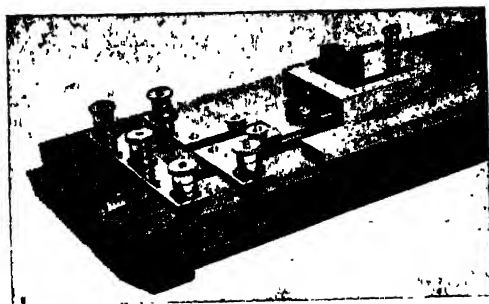
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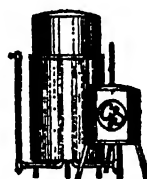


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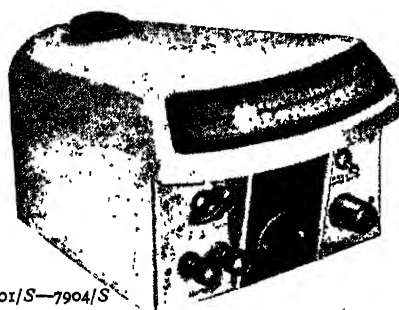
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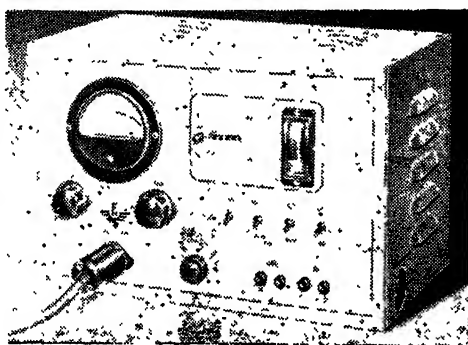
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# Current Science

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## IRIDESCENT CRYSTALS\*

**L**ABRODORITE, opal and mother-of-pearl are examples of naturally occurring substances which exhibit a play of colours. The present article deals with a different case, namely that of potassium chlorate. That crystals of this substance occasionally form with a tabular habit displaying a spectacular type of iridescence has long been known to those engaged in the manufacture of this chemical. The phenomenon came into prominence through the writings of the famous trio of British physicists of the nineteenth century, namely, Stokes, Rayleigh and Kelvin. Stokes was the first to make a serious study of the case and was led to recognise that the iridescence had its origin in the reflection of light at twin-plane boundaries within the crystal. Rayleigh developed a mathematical theory of such reflection; he came to the conclusion that a single twinned layer was insufficient to explain the observed effects and postulated that the iridescent crystals were poly-

synthetically twinned. In his Baltimore lectures, Kelvin drew attention to the interest of the case in relation to molecular tactics within a crystal and was led to speculate on the particular circumstances which led to the repeated twinning so frequently exhibited by potassium chlorate. Later observers have published some further observations, but the general complexion of the subject was left fundamentally unchanged. The present authors were led to undertake a study of the phenomenon by reason of the fact that a large collection of the iridescent crystals was at their disposal. Many new facts have emerged from these studies and they throw a fresh light on the theoretical aspects of the case.

By far the most interesting specimens are those crystals which indicate by their optical behaviour the possession of a high degree of regularity in their polysynthetic twinning. Such crystals exhibit sharply defined monochromatic bands when white light is incident nearly normally on them and the reflected light is viewed through a spectroscope. A careful

\* From the Presidential Address by Sir C. V. Raman to the annual session of the Indian Academy of Sciences at Trivandrum.

FIG. 1.

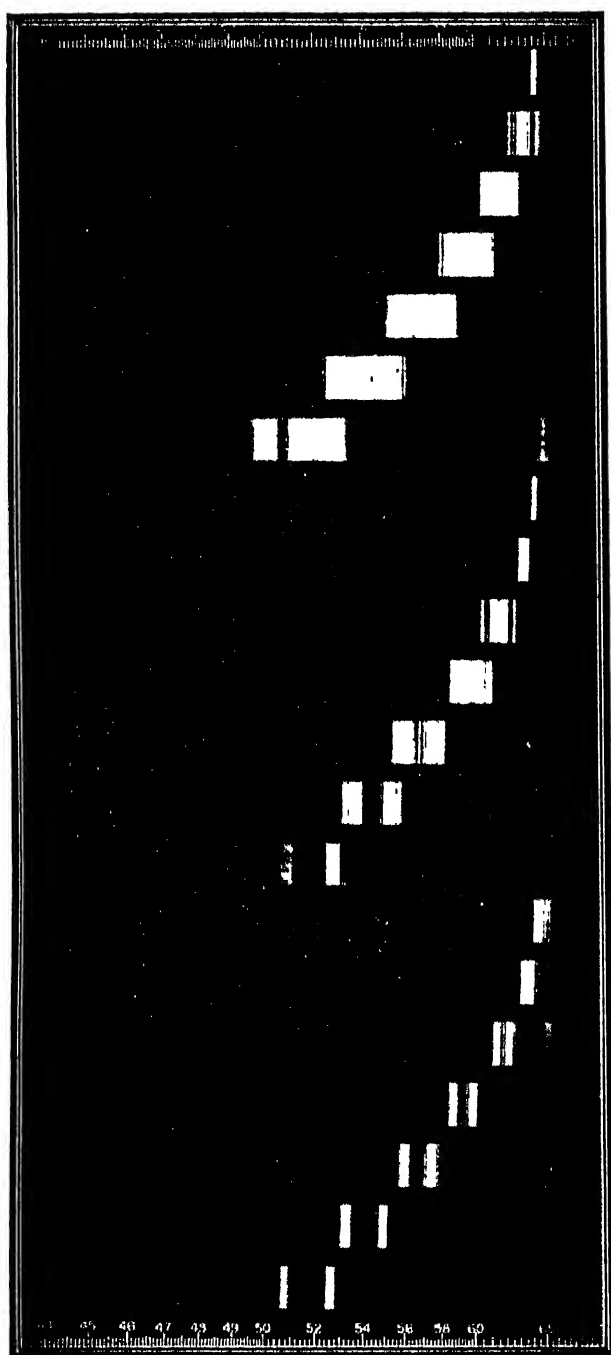
azimuth 90°

FIG. 2.

azimuth 30°

FIG. 3.

azimuth 5°



Reflection Spectra of Potassium Chlorate

study of several such crystals has brought to light the fact that the spectral character of the reflections depends in a most remarkable manner on the azimuth of the plane of incidence of the light as well as on the obliquity of such incidence. This dependence is exhibited very clearly in the sequence of spectrograms reproduced in the accompanying Figs. 1, 2 and 3. Each of these figures shows a series of seven spectra with the angle of incidence increasing by steps of  $10^\circ$  from  $5^\circ$  to  $65^\circ$ . The spectra recorded in Fig. 1 refer to the case in which the plane of incidence makes an angle of  $90^\circ$  with the particular plane in which the coloured reflections totally vanish and which is also the plane of crystallographic symmetry common to all the elements of the twinned crystal. In Fig. 2 the plane of incidence makes an angle of  $30^\circ$  with the latter plane, while in Fig. 3 it makes an angle of only  $5^\circ$  with the same.

An examination of the spectrograms reproduced shows that when the azimuthal angle is small (Fig. 3), the sharply defined *single* monochromatic reflection recorded at nearly normal incidence splits into a *doublet* the components of which drift away from each other and also towards shorter wavelengths at increasing obliquities of incidence. On the other hand, when the azimuthal angle is  $90^\circ$  (Fig. 1), two new components make their appearance, one on either side of the central band, and their intensity increases progressively with increasing obliquity of incidence. The three components of the *triplet* thus produced drift towards shorter wavelengths and at the same time grow more diffuse. At intermediate azimuths (Fig. 2), the reflection spectrum consists of a *quartet* of lines due to the fact that while the central component splits into a doublet which widens as in the case of small azimuths, two additional outer components also make their appearance as in the case of an azimuthal angle of  $90^\circ$ , though with smaller intensities than in the latter case. The whole situation may be thus summarised by the statement that the spectrum of the reflected light is, in general, a *quartet* of lines; at nearly normal incidence, the outer components are of vanishingly small intensity and the central components are an unresolved doublet, thus resulting in what appears as a *single* monochromatic reflection. When the azimuthal angle is small, the outer components have vanishingly small intensity for all incidences and the spectrum is therefore seen as a *doublet*. On the other hand, when the azimuthal angle is  $90^\circ$ , the outer compo-

nents have a notable intensity while the inner components are unresolved, thereby giving us a *triplet*.

Standing in the closest relation to the spectral behaviour of the reflected light are the states of polarisation of its spectral components revealed by our studies. It has been observed that both the components of the doublet reproduced in Fig. 3 are *plane-polarised* but in opposite ways. Further, and provided that the angle of incidence is not too large, the outer components of the triplet in Fig. 1 also exhibit *plane polarisation* but in a different way from the doublets appearing in Fig. 3. The central component of the triplet in Fig. 1 is however always *unpolarised*. The quartet of lines recorded in Fig. 2 exhibits in respect of the two outer components the same features of polarisation as in Fig. 1, while those of the inner components correspond to those in Fig. 3. A further interesting observation is that when the crystal is rotated in its own plane about the normal, the angle of incidence being kept constant, the two central components of the quartet approach each other and after coinciding when the azimuthal angle is  $90^\circ$ , separate again. The unpolarised state of the central component in Fig. 1 is thereby revealed merely as a consequence of the overlap of two components polarised in perpendicular planes.

The whole group of phenomena set forth above finds a natural explanation when we consider *firstly*, the division of an incident beam of unpolarised light into *two beams* polarised in perpendicular planes when it enters the birefringent crystal; *secondly*, the character of the reflection which each of these beams suffers when it meets the twin-plane boundaries inside it, and *thirdly*, the propagation of the beams of light thus reflected within the crystal before their final emergence from it. In general, corresponding to *each* of the two pencils into which the incident beam divides on entry, we have *two* differently polarised sets of beams reflected at the regularly-spaced twin-plane boundaries. Hence, the light emerging from the crystal consists of *four* different sets of beams the retardations suffered by which are in general different from each other. It follows that there would, in general, be four sets of sharply-defined maxima in the spectrum of the light reflected by the regular stratifications of the crystal. The reduction of the quartet of lines thus expected on theoretical grounds to a singlet, a doublet or a triplet as the case may be, depending on the azimuth and obliquity of incidence are

derivable as consequences of the special circumstances of each case. For instance, when the azimuthal angle is small, one of the two reflections in each case vanishes and the quartet reduces to a doublet. If, in addition, the angle of incidence is also small, the light paths corresponding to the two surviving sets of beams differ inappreciably and we observe a single sharply defined monochromatic band in the spectrum. *Per contra* when the azimuthal angle is  $90^\circ$  and the incidence is sufficiently oblique, all the four sets of reflected beams have to be

considered, but by reason of the symmetry of the case the paths for the two middle components continue to be identical and hence we observe a triplet. The explanations indicated above are completely substantiated by the observed states of polarisation of the components in each case taken in conjunction with the known characters of the birefringence of the crystal.

C. V. RAMAN.

D. KRISHNAMURTI.

### NOBEL AWARD FOR MEDICINE, 1952

DR. SELMAN A. WAKSMAN, Professor of Soil Microbiology at Rutgers University, New Jersey, has been awarded the 1952 Nobel Prize for Medicine, for his discovery of streptomycin. His interest in the chemistry of living processes began many years ago in Russia—he was born in the Ukraine in 1888—and by 1915, five years after his arrival in the U.S.A., he had already undertaken a study and classification of the actinomycetes. His investigations were mainly agricultural until 1939, when Rene Dubos, who had been one of Waksman's students at Rutgers University, isolated from a spore-bearing soil bacterium, a substance (gramicidin) which appeared to be capable of destroying pathogenic bacteria. About this time also Gleming's discovery of the anti-bacterial action of penicillin was being developed for therapeutic purposes, and Waksman turned his full attention to an attempt to isolate from the soil micro-organisms possessing anti-biotic properties. It was early in 1944 that with Schatz and Bugie he announced the isolation from *Streptomyces griseus* of streptomycin, a

substance antagonistic to both gram-negative and gram-positive bacteria including *Mycobacterium tuberculosis*. The fact that streptomycin was the first effective anti-biotic to be used in the treatment of tuberculosis has become a part of medical history. One of its most notable successes has been in tuberculous meningitis, no longer an invariably fatal disease.

Streptomycin has well-known limitations, among them its toxic effect on the eighth nerve and the development of resistance by tuberculosis bacilli. In reviewing the possibility of further advances in this field, Dr. Waksman wrote in the *British Medical Journal* two years ago: "Sooner or later other anti-biotics will be found which are more effective than either (streptomycin and neomycin) and less toxic. The fact that in the various surveys on anti-biotic production by micro-organisms the acid-fast bacteria are found to be among the most sensitive forms points to the possibility of the existence of such agents. Finding these is merely a matter of further search".

(—By courtesy of the *British Medical Journal*)

### THEORY OF EARTH'S INNER CORE

FOR some years it has been known that the earth contains a central core with a radius of 2,200 miles. This central core is physically distinct from the outer mantle, which extends up the further 1,800 miles to the earth's surface. Several distinct lines of evidence have pointed to the bulk of this central core being in a fluid state. Over the years from 1935 to 1939, it was concluded that the central core contained an inner core with a radius of about 800 miles. Professor Bullen, Professor of Mathematics at Sydney University, Australia,

has recently adduced some evidence to the effect that while the outer part of the central core is fluid, the inner core is solid, with a density of about 18 times that of water. There is some division of opinion on the question of the composition of the outer part of the central core, but his work favours the view that the central core consists of a high density liquid form of silicate rock with a density about 11 times that of water, and that the inner core is chemically distinct and consists of iron, nickel and probably some denser metals,



## LATE PRE-CAMBRIAN GLACIATION IN CENTRAL INDIA

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IT is a well-known fact that at the end of the late Pre-Cambrian period there occurred a widespread ice age. Nantow Tillite of China, the extraordinarily thick glacial series of Adelaide System in Australia, and the extensive tillite of Numees Series in South Africa are eloquent proof of glaciation in the immediate vicinity of India while later Pre-Cambrian tillites are quite as well developed and have been reported from Norway, Scotland, Spitzbergen and from many localities in North America. In India, Sir Thomas Holland suggested in 1908 that Blaini conglomerate as found near Simla may be much older than the Permo-Carboniferous and may belong to Late Pre-Cambrian glaciation. The Blaini conglomerate is now relegated to the Permo-Carboniferous age by most people in spite of the fact that the succeeding Krol Series is totally devoid of fossils.

The senior author, while mapping the Son Valley in 1948 observed that the basal bed which marks the lowermost horizon of Lower Vinhyans and overlies the Bijawar Series, was composed of a fine-grained siliceous rock, in which are distributed angular and sub-angular boulders of vein quartz varying in size upto a maximum of 9", as well as subordinate amounts of jasper and trap pebbles. This horizon extends for nearly 100 miles between River Banas and River Gopath, the two tributaries of River Son. It was thought that such boulders might have been the result of torrential action. But the unassorted assemblage, combined with great extension, suggested the possibility of glacial action. This boulder bed merges into a coarse-grained quartzite at the top. The matrix on examination under a microscope reveals the presence of abundant flesh-coloured fresh feldspars. The presence of feldspar strengthened the belief that ice has led to the formation of such a deposit. It is interesting to note that Oldham<sup>1</sup> also has described a similar rock occurring between River Banas and Gopath which he thinks 'is in fact an indurated boulder clay of a structure similar to the glacial boulder clays of Europe and the Talchir boulder clays'.

The junior author while working in Bundelkhand in Ken Valley in 1950 (Map Ref. No. 54.P/14) found that just below the Semri Series and overlying the Bijawars, there is a remarkable formation of 150' thickness which forms the most prominent scarp in the locality.

It consists of a totally unstratified clay of chocolate brown colour in which are embedded pieces of varied lithology—sandstones, quartzites, conglomerates, cherts and traps, representing the Bijawar Series and granite pieces



FIG. 1. Angular and sub-angular rock fragments of all grade embedded in a dark argillaceous matrix (Unassorted breccia of sporadic fragments). Note the unstratified nature of the deposit. Locality Ken Valley

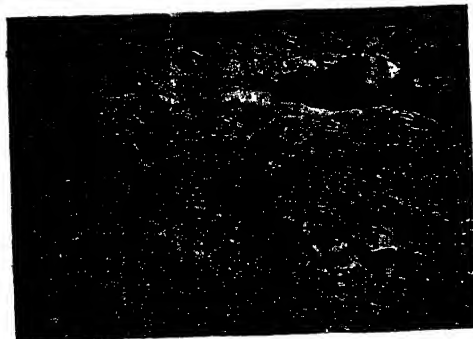


FIG. 2. Big boulders, angular and sub-angular, embedded in a dominant dark matrix. The boulder (block) in the fore-ground is of quartzite and measures 3 feet across. Field photo of the Tillite occurring in Ken Valley.

derived from Bundelkhand granite. These sparsely enclosed constituents display most remarkable variation in size and shape. Boulders and blocks measuring 3' across are not uncommon, while every grade down to silt size is represented. They are angular and sub-angular in shape. Under the microscope, angular fragments of rock types mentioned earlier are seen embedded in a ferruginous matrix. This formation with its peculiar characters extends to 20 miles towards west.

The extreme variation in grain-size, the dominance of argillaceous matrix, and a lithological assemblage derived from distant localities combined with the great thickness and lateral extent, strongly suggest that the deposit is a typical tillite.

It will be found that the horizon of this boulder bed in Bundelkhand is the same as that of the boulder bed of Son Valley, being

situated at the bottom of the Semris and at the top of the Bijawars. The shortest distance between the two areas is about 150 miles and the glaciation seems to be fairly extensive in scale.

This study indicates that India did not escape the late Pre-Cambrian glaciation which affected the neighbouring regions such as Australia, China and South Africa. Considering the principle of universality of great ice ages and also allowing for the fact that the precise datum is not obtained by comparing the evidences of glacial action in distant countries we have to reconsider the conventional position of Vin-dhyans. They may be younger than what they are believed to be.

---

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### SCIENTIFIC SPIRIT IN ANCIENT INDIA\*

THE development of a rational attitude of mind and a spirit of inquiry into the mysteries of the universe, which form the basis of all scientific study, is rightly claimed to be one of the greatest legacies of Greece to humanity. As in Greece, so in India, speculative philosophy was followed by a true scientific inquiry based on close observation of facts and phenomena. The method of science, which has been described fully in Indian literature, involves, among others, perception, observation, experiment, inference and hypothesis. By application of this method great advances were made in astronomy and medical science including anatomy and surgery. These led to the growth of other sciences such as mathematics and chemistry. The actual achievements of the Hindus in these branches of science were very great and compare favourably with those of any other ancient people.

Even in other branches such as botany, zoology, mineralogy, metallurgy and physics, where actual attainments were not as great, we find the scientific process at work, viz., observation and classification of phenomena, experiment and inference. As regards botany, reference may be made in particular to the classifi-

cation of plants, treatment of seeds for successful germination, study of diseases of trees and the method of improving flowers and plants—even to the extent of changing their essential properties. More striking is the detection in plants of the phenomena of life and death, sleep and waking consciousness, of pleasure and pain, sensitiveness to heat and cold, and movements towards what is favourable and away from what is unfavourable. In zoology we find various classifications of animals on the basis of their *vija* (ovum or seed), the number of senses possessed by them and according to their habitat, mode of life and dietary value. In mineralogy and metallurgy we have reference to the working of underground mines, manufacture of various metals and a scientific process of treating metals. The iron pillar of Delhi is a living testimony to the forging of iron on a scale unknown to recent times and the process, now forgotten, of evolving a type of iron which does not rust in 1,500 years. The true nature of gems and their classifications show some knowledge of geology.

The study of ancient Indian science is yet in its infancy, and if India suffers in this respect in comparison with Greece and other countries, it is perhaps due more to our ignorance than to her actual backwardness, either in scientific spirit or in actual achievements in various branches of science,

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\* From the 14th Sir J. C. Bose Memorial Lecture, delivered by Dr. R. C. Mazumdar at the Bose Institute, on 30th November 1952.

# ACTION OF DIETHYLAMINOETHYLPHENOTHIAZINE (2987 RP, DIPARCOL) AND MYANESIN ON TONE AND REFLEX REGULATING CENTRES OF THE NERVOUS SYSTEM

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THE mode of action of drugs used for the treatment of Parkinson's disease in man is not fully understood yet. It is now assumed that the nicotinolytic action of these drugs bears some relation to their therapeutic activity.<sup>1</sup> However, it seems desirable to work out more detailed information on the pharmacology of these substances.

For that purpose experiments were carried out on cats, using a method which proved to be of value in the determination of the action of drugs on interneurons of the Central Nervous System:<sup>2,3</sup> the animals were anesthetised with either Dial (0.5 c.c./kg. of the commercially available solution, intraperitoneal†) or with Chloralose (80 mg./kg. intravenous). The knee jerk was elicited at regular intervals (every 10 sec.) with an automatically driven hammer.<sup>2</sup> Electrodes, covered with insulating material except for the tip, were inserted into the brain stem using a simplified Horsley-Clark instrument. For unipolar stimulation rectangular impulses of a frequency 100 per sec were used. According to the site of stimulation, three different types of effects could be observed in these experiments during the period of central stimulation: inhibition and facilitation of the knee jerk as known from the work of Magoun, *et al.*, were most frequently encountered. Occasionally a hypertonus of the quadriceps muscle with repulsive components or clonus following each reflex contraction was observed as the result of the stimulation. The rise of tone was usually not accompanied by any alteration of the tension developed by the phasic reflex. These effects lasted only for the period of actual

stimulation, usually ½ to 1 minute. The drugs were injected intravenously. The position of the electrode was verified at the end of the experiment macroscopically. The points which on stimulation gave facilitation or inhibition of the phasic reflex contraction coincided with the regions indicated by Lindsley, Schreiner and Magoun,<sup>2</sup> i.e., basal diencephalon, pontile tegmentum, certain parts of the bulbar reticular formation and lower reticular formation respectively. When rise of tone was observed, the tip of the electrode was always found to be situated near the vestibular nuclei in the medulla.

In these experiments the action of Diparcol‡ as a representative for anti-Parkinson drugs was compared with the well-established action of Myanesin.<sup>2,3</sup> If Diparcol was injected in a dose of at least 20 mg./kg., a block of the interneurons involved in the facilitation or inhibition of the monosynaptic test reflex (i.e., knee jerk) could be observed. Following the injection of such a dose (usually given in at least two portions, each 10 mg., at an interval of 5 minutes), the inhibition as well as the facilitation of the knee jerk, on stimulation of the appropriate points in the brain stem, became gradually reduced and finally disappeared completely. Fig. 1 gives an example of the action

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† Ciba Ltd., Bale

‡ We are obliged to Specia, Paris, for kindly supplying the compound.

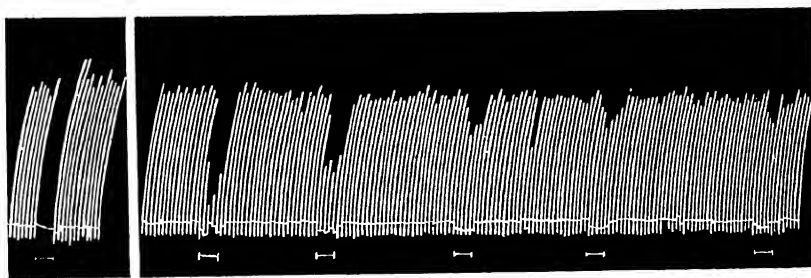


FIG. 1. Cat in Chloralose Anesthesia. Record of the knee jerk. The periods of central stimulation are indicated at the bottom of the record. 20 mg./kg. Diparcol were injected intravenously between the first and the second part of the figure. The injections were given in 10 mg./kg. doses, at an interval of 5 minutes. The right part of the record starts with the end of the second injection.

of Diparcol on the centrally induced reflex inhibition. In doses below 20 mg./kg., Diparcol was regularly without any significant effect on central facilitation and inhibition respectively.

In the action described so far, Diparcol resembles Myanesin closely,<sup>6</sup> which also abolishes the effect of facilitory and inhibitory stimulation of the brain stem. The striking fact noticed was when the effects of central stimulation of the reticular formation resulted in hypertonicity of the extensor muscles, Diparcol in as low a dose as 5 mg./kg. completely abolished the tonic effect without appreciably interfering with the

abolishes any centrally induced tonic response. For the blockade of central inhibition and facilitation of the knee jerk however, at least 25-30 mg./kg. have to be administered in cats.

On the basis of these observations, we come to the conclusion that the centres of the reticular formation influencing the tone are considerably more susceptible to the paralysing action of interneuron blocking drugs such as Myanesin and Diparcol, than the reflex regulating centres. This observation corresponds well to the clinical experience, indicating that the increased muscle tone in disorders of the

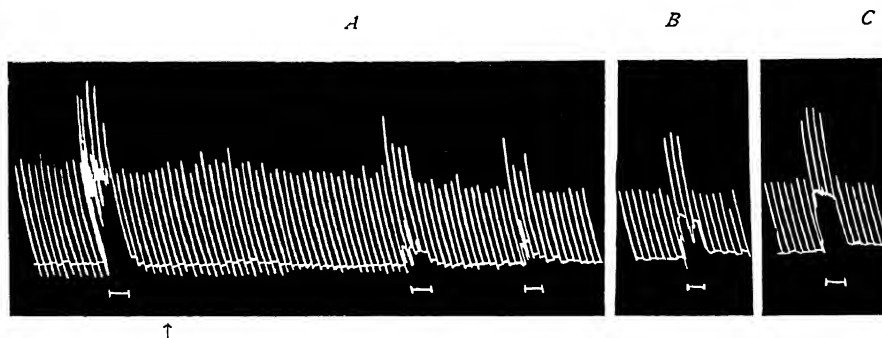


FIG. 2. Cat in Dial-Anesthesia, Record of the knee jerk. White marks indicate the periods of stimulation. At the arrow 5 mg./kg. Diparcol are injected intravenously. Record B demonstrates the effect of central stimulation 25 minutes after the injection, record C 40 minutes after the injection of Diparcol.

phasic reflex (Fig. 2). This effect of Diparcol lasted in different experiments from 20-40 minutes. In one instance (cf. Fig. 2), a small facilitation of the phasic reflex became even manifest at a time when the tonic contraction of the quadriceps muscle due to central stimulation was completely suppressed by Diparcol.

Experiments were then performed to demonstrate whether such a difference in the sensitivity of tone- and reflex-regulating areas in the brain stem exists also for Myanesin. In two experiments performed for that purpose, we observed that Myanesin also in a dose of 5 mg./kg.

extrapyramidal motor system is particularly reduced by Diparcol.<sup>7</sup>

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### ATOMIC FURNACE FOR DETECTION OF IMPURITIES

A NEW and highly accurate method of using atomic energy to detect and measure impurities in foods, pharmaceutical products, metals and other materials has been developed at the Oak Ridge National Laboratory, Tennessee. The technique involves placing the test sample in a graphite reactor or 'atomic furnace', and exposing to neutron bombardment, so that traces of impurities will be rendered radio-active. Highly sensitive instruments and detectors are then used to measure the exact quantities of

impurities present. This is possible because the elements to be tested, when irradiated, produce radio-active isotopes having characteristics never exactly duplicated by other radio-isotopes. This analysis technique, which should help to ensure purity of the manufactured product, is now being offered to industrial, scientific and medical organisations in other countries, by arrangement with the U.S. Atomic Energy Commission.

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ON THE LAKI BEDS IN DHARMPUR  
SUBATHU REGION, SIMLA HILLS

MEDLICOTT<sup>1</sup> recognised the Subathus, but he included therein the overlying Dagshais and Kasaulis as well. In the first edition of the *Manual of Geology* (1879), however, the name Subathu was restricted to the oldest members of the sequence and the whole connected strata were designated as Sirmur series. According to Auden,<sup>2</sup> in the Solon-Subathu region, the Dagshai and Subathu rocks rest upon Simla slates and have been overthrust by rocks of the Krol Nappe.

During the course of two brief visits to Dharmpur (30° 54' N.: 77° 1' 30" E.) during the months of April and August 1952 and one to Subathu (30° 58' N.: 76° 59' 45" E.) I made collections of the Subathu rocks from a number of fossil localities. Examination of rock sections has revealed the following fauna: *Assilina*

*granulosa*, *A. spinosa*, *A. leymierie*, *A. cf. mamillata*, *A. cf. dandotica* and others; *Nummulites atacicus*, *N. globulus*, *N. cf. mamilla*; *Lockhartia* sp., *Rotalia* sp., *Quinqueloculina* sp. and other smaller foraminifera.

Vredenburg<sup>3</sup> stated that the Subathus were the equivalents of Kirthars. Pinfold<sup>4</sup> brought their lower age limit down to Lakis but Pilgrim and West<sup>5</sup> restored the Subathu series to Middle Eocene and stretched the Uppermost Subathu beds to Upper Oligocene.

The presence of *A. granulosa*, *A. spinosa*, *A. leymierie* and *N. atacicus*, as noted above, stamps these sediments as Laki and the absence of *N. irregularis* and *N. subirregularis* is indicative of Middle Laki. *N. irregularis* is confined to Lower Laki and has not hitherto been reported from the Upper Laki in the Indian region. No Kirthar foraminifera were noticed in the area studied.

A more detailed account of the work will be published elsewhere.

I am deeply indebted to Prof. S. R. Narayan Rao, whose kind guidance has made this work possible.

Dept. of Geology,  
Lucknow University,  
Lucknow,  
September 3, 1952.

SUKHBIR SINGH.

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### AUTHIGENIC TOURMALINE FROM THE SATYAVEDU STAGE (UPPER GONDWANAS) NEAR MADRAS

In the course of a further examination of the heavy mineral assemblages of the Sriperumbudur and the Satyavedu stages<sup>1</sup> a number of well-rounded detrital tourmaline grains with jagged overgrowths of authigenic tourmaline were noticed in the Satyavedu stage. These are not seen in the Sriperumbudur stage. Nearly 17 per cent. of the total number of these detrital tourmaline grains have overgrowths of authigenic tourmaline, the overgrowths averaging to about 22 per cent. of the size of the original grains, the largest overgrowth being 0.10 mm. in length. These are illustrated in the accompanying photo-micrographs (Figs. *a* to *e*). In each of these grains, the authigenic portion has a slight tinge of the same colour as the host grain and is in complete optical continuity with the host as evidenced by identical position of maximum absorption and simultaneous extinction. Further, the authigenic overgrowth is seen only at one end of the "c" axis of the host grain irrespective of its elongation. According to Alty<sup>2</sup> the authigenic overgrowths on tourmaline occur at that end of the "c" axis which is the antilogous pole of the mineral.

In each of the grains with authigenic overgrowth here is a zone of roots or reorganisation clearly seen between the authigenic portion and the host grain where the two are welded together (Fig. *e*). This zone of roots or reorganisation, according to Krynine,<sup>3</sup> "is characterised by pitting and etching of the nucleus with roots of the overgrowths entering these pits".

Detrital tourmaline grains with overgrowths of authigenic tourmaline have been reported by Stow, Martens and Krynine<sup>4</sup> respectively from the Lower Devonian, Lower Silurian and Upper



FIG. 1. Photomicrographs showing detrital tourmaline grains with overgrowths of authigenic tourmaline from the Satyavedu stage (Upper Gondwanas) near Madras.

*a*. A well-rounded grain set in the position of maximum absorption; the "c" axis coincides with the elongation of the grain and the authigenic portion occurs at one end of the "c" axis.  $\times 120$ .

*b*. Same as *a*, set in the position of minimum absorption.  $\times 120$ .

*c*. An oval grain set in the position of maximum absorption; the "c" axis lies across the elongation of the grain and the authigenic portion occurs at one end of the "c" axis.  $\times 120$ .

*d*. Same as *c*, set in the position of minimum absorption.  $\times 120$ .

*e*. An oval grain set in the position of minimum absorption to show the zone of roots or reorganization between the authigenic portion and the host grain.  $\times 120$ .

Cambrian formations of the central part of the Appalachian geosyncline; the present paper records such an occurrence for the first time in India. According to Krynine such occurrences are restricted to thin stratigraphic horizons over wide areas and are thus of correlative value. In the present case, it is interesting to note that detrital tourmaline grains with overgrowths of authigenic tourmaline are found only in the sediments of the Satyavedu stage and not in the Sriperumbudurs. This feature may be used in distinguishing between these two sets of coastal upper Gondwanas, and in identifying and correlating stray and local exposures of the Satyavedu stage.

The writer is thankful to Prof. L. Rama Rau and Sri. M. R. Srinivasa Rao for their valuable guidance and to Sri. M. M. Veerabhadraiah for assistance in photomicrographic work.

Dept. of Geology,  
Central College,  
Bangalore,  
October 27, 1952.

C. GUNDU RAO.

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#### INTERFERENCE OF FORMALDEHYDE IN THE VOLUMETRIC ESTIMATION OF FERROUS SALTS

It has been shown by Gopala Rao, *et al.*, that alcohols, sugars, etc., interfere in the volumetric estimation of ferrous salts by potassium dichromate. Experiments now carried out show that formaldehyde behaves similarly. It is found that when a drop of potassium dichromate solution is added to an aqueous solution of formaldehyde, containing sulphuric acid, phosphoric acid and a suitable redox indicator like diphenyl benzidine, the color of the oxidized form of the indicator is immediately produced, showing that the direct reaction between formaldehyde and dichromate is very slow. But in the presence of ferrous salt, the reaction between formaldehyde and dichromate is induced by the reaction between ferrous salt and dichromate. We have also found that ferrous salt does not induce the reactions between formaldehyde and ceric sulphate or formaldehyde and sodium vanadate. Hence we recommend the use of ceric sulphate or sodium vanadate for the esti-

mation of ferrous salts in the presence of formaldehyde.

Chemical Labs.,  
Andhra University,  
Waltair,  
August 4, 1952.

M. NARASIMHA SASTRI.  
M. V. RAMA RAO.  
G. GOPALA RAO.

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#### INFLUENCE OF FREEZING ON THE VOLUME OF JUICE EXTRACTED AND ASCORBIC ACID CONTENT OF CERTAIN FRUITS

In quick freezing<sup>1</sup> though destruction of cell structure is avoided,<sup>2,3,4</sup> the cells are killed out. Fruits kept at  $-20^{\circ}\text{F}$ . for two days become as hard as stones and a few hours after removal from this temperature, they are so soft as to render a fair amount of the juice being squeezed out by hand pressure.

Studies were carried out by extracting the juice from amla, kept at  $-20^{\circ}\text{F}$ . for 48 hours as also those at room temperature for the same period, in a hydraulic press employing the same pressure for both the samples. It was found that quick frozen material yielded about 12 per cent. more juice. It was of interest to determine the ascorbic acid content of the juice.<sup>5</sup> The results (Table I) show that more ascorbic acid is recovered as a result of getting more juice from the frozen amla, while the concentration of ascorbic acid in both the juices is practically the same, showing thereby that freezing does not involve any dilution of the juice. The observations carried out with other materials are recorded in Table I.

TABLE I

Fruit	Temperature of storage	% increase in volume of juice	Excess of ascorbic acid obtained over that kept at room temperature in mg. per 100 g.
Mango	$-20^{\circ}\text{F}$ .	20.8	6.65
Cashew apple	$-20^{\circ}\text{F}$ .	14.0	42.6
Amla	$-20^{\circ}\text{F}$ .	12.0	49.6
Lemon	$-20^{\circ}\text{F}$ .	14.0	5.86
Orange	$-20^{\circ}\text{F}$ .	19.0	14.50
	$20^{\circ}\text{F}$ .	16.0	9.04
	Refrigerator temperature	8.0	4.94

In the case of oranges, kept at varying temperatures, a progressive increase in the volume of juice was obtained, the values for total

ascorbic acid following the same trend. This would appear to be due to the destruction of the cells which are primarily responsible for the resistance offered when the juice is extracted.

The studies reported here have some practical significance. A greater volume of juice coupled with increased vitamin C could be obtained by quick-freezing the material prior to extraction of juice. It might indeed be worthwhile to try this method in the case of sugarcane, to see whether it would be possible to obtain more juice and proportionally more sugar from the same tonnage of sugarcane.

Further work on some other aspects concerning freezing to  $-20^{\circ}\text{F}$ . is in progress.

The authors are indebted to Dr. K. V. Giri for his keen interest in the progress of the investigation.

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#### USE OF AMMONIUM MOLYBDATE AS A CATALYST IN THE IODOMETRIC ESTIMATION OF FERRIC IRON

AMMONIUM MOLYBDATE was used as a catalyst in the hydrogen peroxide-iodide and bromate-iodide reactions by Kolthoff and co-workers. The dichromate-iodide reaction was also shown to be catalysed<sup>2</sup> strongly. In the present work, we studied the iodometric estimation of iron and found that ammonium molybdate does catalyse the reaction:  $2\text{Fe}^{+++} + 2\text{I}^- \rightarrow 2\text{Fe}^{++} + \text{I}_2$ .

The reaction was complete in 10 minutes using 3 drops of the catalyst; also immediately with 8 or more drops of the catalyst. The estimated amount of iron by this method is the same as that obtained by using cuprous iodide as catalyst or by reducing the trivalent iron to divalent stage and titrating it with either standard permanganate or dichromate solutions. Since it is troublesome to prepare cuprous iodide or to reduce ferric salt to ferrous stage, the quickest as well as an accurate method is to take 25 c.c. of ferric (equivalent to about 0.14 gm. of iron) salt in solution (not containing much acid) in a stoppered bottle, add 10 c.c. of 2N HCl, 10 c.c.

of 10%  $\text{NaHCO}_3$ , 8 drops of 20% aqueous ammonium molybdate, 25 c.c. of 12% KI solutions and to titrate with standard thiosulphate.

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#### AMIDE FORMATION FROM ACIDS AND UREA

CHERBULIEZ and LANDOLT<sup>1</sup> have described a new general method for the preparation of amides from urea and acids. The present work was undertaken with a view to investigate, in a systematic manner, the application of the method to different classes of acids. Besides saturated monobasic acids including substituted ones, unsaturated and dibasic acids have been tried and the results indicate that, in this method, the presence of any such functional group as will facilitate the formation of a 5- or 6-membered ring, hinders the formation of amides. Propionic, butyric, palmitic and stearic acids, all give the amides in good yield. Further, while diphenyl acetic acid gives the amide (70-80% yield in different batches), which when crystallised from benzene melts at  $170-71^{\circ}$  ( $167-68^{\circ}$ , highest reported in the literature), diphenyl chloroacetic acid and diphenyl glycollic acid both yield diphenyl hydantoin (formation of a 5-membered ring). In the dibasic acid series, succinic acid yields the imide (both with one and two moles of urea) and adipic acid gives the diamide. Malonic acid fails to give the amide; the resulting product melts with decomposition above  $360^{\circ}\text{C}$ ., dissolves in hot water and in alkali solution and is reprecipitated on acidification. It may probably be malonyl urea. Cinnamic acid is reported to give with urea, 4-phenyl-hydouracil.<sup>2</sup> Besides this compound, another product, m.p. 220-22 (alcohol) has now been isolated from the reaction product of cinnamic acid and urea. Phenyl and diphenyl urea (sym.) have also been used in place of urea and give with diphenyl acetic acid, N-phenyl diphenylacetamide.

An example of the non-formation of amide from urea and acids consequent on the facile formation of a 5-membered ring is afforded by the reaction between benzoic acid and urea first studied by Biltz,<sup>3</sup> who obtained 5:5-diphenyl hydantoin (45% yield) by their interaction at



elevated temperatures. Sikdar and Ghosh<sup>1</sup> obtained it in about 44% yield. None of these workers, however, give any account of the low yield of the above compound. The present authors have isolated besides 5:5-diphenylhydantoin, two additional products, one melting at 153-54° and the other at 269-70°, both containing nitrogen, from the final product of the reaction between benzoic acid and urea at 220-30°. The reaction mass was treated with alcohol and benzene and separated into three crystalline products. It was noted that after the extraction of the resulting mass by aqueous caustic soda, a residue was left behind of which neither Biltz nor Sikdar and Ghosh have made any mention. This residue was further worked up and the two additional products were obtained. The products, m.p. 153-54° and m.p. 269-70°, showed considerable depression of the melting point on admixture with authentic samples of benzoic acid amide (m.p. 153-54°) and 5:5-diphenyl hydantoin (m.p. 286°), respectively. These compounds which appear new, have been subjected to degradation and the work on their characterisation now in progress, will be published later on.

The authors wish to express their thanks to their colleague, Dr. M. A. Aziz, for helpful suggestions.

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### $\beta$ -NAPHTHYL SULPHIDE AS SPOT TEST REAGENT FOR METALLIC RADICALS

IN our attempts to use metallic chlorides as chlorinating agents in connection with some other work on hand, it was found that when an alcoholic solution of 2-2'-dihydroxy-dinaphthyl sulphide<sup>1</sup> (m.p. 212° C.) was treated with cupric chloride, a red compound. (m.p. 158° C) was obtained which retained sulphur, contained copper but no chlorine. Since the formation of this compound was practically immediate, it led to an examination to see what other common metallic radicals would respond to this sulphide by giving colour reactions. It was found that silver nitrate, lead nitrate, mercurous nitrate, bismuth trichloride, ferric chloride, manganese

chloride, cobalt chloride gave precipitates which had light chocolate, pale yellow, pale brown, white, dark buff, flesh and grey colours respectively.

Pieces of filter-paper were spotted with one per cent. acidic solutions of salts of copper, bismuth, iron, manganese, silver, mercury and cobalt when it was found that, after exposure to ammonia, about one per cent. alcoholic solution of the sulphide gave immediate colour reactions as follows: Silver nitrate—greenish yellow; Mercurous nitrate—dirty yellow; Ferric chloride—yellow; Copper chloride—"copper" colour.

The conditions necessary for the complete precipitation of metallic radicals using this reagent and the use of the latter in chromatographic identification and estimation of these radicals will be published elsewhere.

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### NUTRITIVE VALUE OF THE SEED PROTEINS OF *SESBANIA GRANDI- FLORA* PERS.

THE seeds of *Sesbania grandiflora* Pers. (Vern.: Agathi, Agasti, Agase) have been reported to contain 68% protein,<sup>1</sup> perhaps the highest on record among vegetable seeds. In view of the possible use of a material so rich in protein to supplement the poor Indian diets, its nutritive value was studied.

The percentage composition of the husked seeds—freed from the tough seed-coat as well as the inner membrane—was as follows: Moisture 7.5, ether extractives 4.2, protein 69.9, ash 4.5, calcium 70 mg. The flour prepared from these seeds was used as the source of protein in the biological tests.

The protein efficiency ratio was determined in weanling rats (groups of 8 each) and the digestibility coefficient and the biological value by the nitrogen balance method in adult rats (6 males weighing 180-200 g.) at 10% level of protein in adequate synthetic diets. As the protein by itself did not support growth—most of the experimental animals lost 2-3 g. in body weight in 3 weeks—the effect of supplementing the protein with casein in various proportions, as also of autoclaving it (30 minutes at 15 lb. steam pressure) was studied.

TABLE I  
Biological value of the seed proteins and the  
effect of supplementation with casein

Protein	Protein efficiency ratio (6 week period)	Digestibility coefficient	Biological value (Nitrogen balance)
1 Casein	1.96 ± 0.05	93.5 ± 0.67	64.5 ± 1.57
2 Sesbania protein	Nil	92.4 ± 1.89	35.6 ± 1.88
3 Casein : Sesbania protein (2 : 1)	1.74 ± 0.07	..	..
4 Casein : Sesbania protein (1 : 1)	1.36 ± 0.14	93.4 ± 1.20	45.6 ± 1.65 50.05 (calculated)
5 Casein : Sesbania protein (1 : 2)	1.11 ± 0.13	..	..
6 Autoclaved Sesbania protein	..	89.0 ± 1.30	35.9 ± 1.85

It is evident that the seed proteins have a low biological value which does not improve on wet-heat processing. In the proportion of 1 : 1, the seed proteins and casein, at a dietary protein level of 10%, do not exhibit any supplementary relationship in respect of their biological values. With regard to growth, however, the two proteins in the several proportions examined exert a significant supplementary effect. But this supplementation is of a low degree, for, even when the dietary protein is made up of a high proportion of casein, its protein efficiency is significantly lower than that of casein itself.

The effect on the growth of weanling rats (groups of 6 each) when the seed flour replaced the tur dhal, as also part of the rice in the

TABLE II  
Effect of substitution of Sesbania seeds in the  
poor rice diet

Diet	Average intake (g. per rat)		Growth (g.)
	Food	Protein	
1 Poor rice diet (5 parts tur dhal, and 78 parts rice)	290.4	31.2	33.0 ± 0.92
2 Poor rice diet (5 parts seed flour and 78 parts rice)	384.4	39.9	23.6 ± 0.84
3 Poor rice diet (10 parts seed flour and 73 parts rice)	288.2	37.2	26.0 ± 1.37
4 Poor rice diet (20 parts seed flour and 63 parts rice)	256.4	47.2	16.7 ± 3.59

conventional poor rice diet<sup>2</sup> was determined over a 6-week period.

Obviously the replacement of even the 5 parts of tur dhal in the rice diet markedly depresses growth but does not appreciably affect food intake. On further replacing the rice with increasing proportions of the seed material, there is an increasingly adverse influence on both appetite and growth, in spite of the enhanced protein content of the diets as well as the protein intake. Thus, even partial substitution of the seeds in the rice diet has a deleterious effect on its over-all nutritive value. There is a substantial reduction in the food intake of animals in Group 3 as compared to Group 2, but the growth rates are not significantly different presumably because the total protein intake is nearly the same in the two groups.

The trend of the results indicate that the seed proteins belong to the class of incomplete proteins which are grossly deficient in one or more essential amino acids. Preliminary paper chromatographic examination has revealed that the protein is deficient in lysine and the sulphur amino acids. The complete amino acid make-up of the protein is under study.

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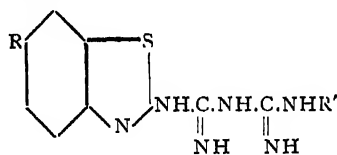
### SOME 2-BENZOTHAZOLYL BIGUANIDES AS POSSIBLE ANTI-MALARIALS

As a part of extensive programme of research, in the chemotherapy of malaria, that has been undertaken in our laboratory to study the effects of different substitutions at either end of the tautomeric biguanide structure, a number of biguanide derivatives having the heterocyclic ring, benzothiazole, attached to the end nitrogen atom of N'-aryl biguanides have been made. In earlier attempts to study the anti-plasmodial activity of compounds, changes have been brought about by the replacement of the sub-

stituents in the paludrine molecule by introducing various pyridyl,<sup>1</sup> quinolyl,<sup>2-4</sup> phenanthryl<sup>5</sup> and acridyl<sup>6,7</sup> rings in place of either *p*-chlorophenyl group or isopropyl group of paludrine. Excepting a few, almost all of these compounds proved to be inactive when tested against experimental malaria using different plasmodia.

Benzothiazole derivatives<sup>8-14</sup> having various substitutions at different positions are being tried since long, for their chemotherapeutic properties. 1-(2-benzothiazolyl)-2-thiourea was found to possess a quinine equivalent of one when tested for suppressive activity against duck malaria.<sup>15</sup> It, therefore, appears that proper substitutions at the proper places in benzothiazole are likely to produce potential chemotherapeutic agents.

In view of the immense possibilities now being offered by the biguanide structure, it was considered to be of interest to synthesise and study the anti-malarial properties of the compounds possessing the heterocyclic ring and the essential features of paludrine, and as such compounds of the type A have now been synthesised.



Type A

R = H, Cl, CH<sub>3</sub> or CH<sub>3</sub>O

R' = Various aryl groups

Compounds of the above type will offer tautomeric possibilities which are said to be responsible for anti-malarial activity of the compound. It will also be noticed that the benzothiazole nucleus can be considered structurally related to the therapeutically active quinoline nucleus in a way where two -CH= groups are replaced by a sulphur atom and also that the nuclear nitrogen atom is in *para*-position to the methoxy group (as in one particular type) as in plasmochin or atebirin; the only difference being that the new 'conductophoric' group has been introduced into 2-position of the heterocyclic part of the ring.

For the synthesis of the compounds of type A as noted below, a number of routes could be suggested, but the most practical and direct one which was successfully employed consisted in reacting the 2-aminobenzothiazolyl hydrochloride with the appropriate arylcyanoguanidine in suitable solvents. The biguanides were isolated as stable crystalline monohydrochlorides with low solubility in alcohol or acetone. The free base was isolated by treating the hydro-

chlorides with dilute sodium hydroxide solution, which were purified by recrystallisation from dilute alcohol.

#### Compounds of Type A

No.	R	R'	M.P. ° C.
1	H	C <sub>6</sub> H <sub>5</sub> -	104-5 Base
2	H	<i>p</i> -ClC <sub>6</sub> H <sub>4</sub> -	198-199 HCl
3	H	<i>p</i> -CH <sub>3</sub> OC <sub>6</sub> H <sub>4</sub> -	193-194 HCl
4	H	<i>p</i> -ClH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> -	128 Base
5	Cl	C <sub>6</sub> H <sub>5</sub> -	196-198 HCl
6	Cl	<i>p</i> -ClC <sub>6</sub> H <sub>4</sub> -	206 HCl
7	OCH <sub>3</sub>	C <sub>6</sub> H <sub>5</sub> -	195 HCl
8	OCH <sub>3</sub>	<i>p</i> -ClC <sub>6</sub> H <sub>4</sub> -	199-200 HCl
9	OCH <sub>3</sub>	<i>p</i> -CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> -	124-125 HCl
10	CH <sub>3</sub>	<i>p</i> -ClC <sub>6</sub> H <sub>4</sub> -	203-204 HCl
11	CH <sub>3</sub>	<i>p</i> -CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> -	194-195 HCl
12	CH <sub>3</sub>	<i>p</i> -CH <sub>3</sub> OC <sub>6</sub> H <sub>4</sub> -	187 HCl

On testing some of the compounds of the above series for their suppressive activity against *gallinaceum* malaria in laboratory-bred chicks, none showed any activity against chick malaria.

The authors' thanks are due to Dr. S. S. Guha and Dr. A. C. Roy for their interest in this investigation.

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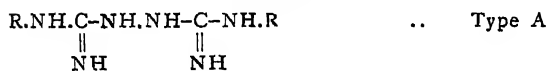
#### SUBSTITUTED HYDRAZODICARBON-AMIDINES

As a result of the study of several types of biguanides Rose<sup>1</sup> concluded that a chlorophenyl residue, associated but not necessarily in conjugation with an amidine or extended amidine system, and in a structure that provides

the necessary cationic functions, will more often than not, lead to an active agent. Previously, Thiele<sup>2</sup> had prepared hydrazo-dicarbonamidine nitrate and the base<sup>3</sup> and had suggested that substituted compounds of the same, may be formed by the action of cyanamides on hydrazine.<sup>3</sup> Since hydrazine possesses distinctive physiological properties and some of its derivatives are therapeutic compounds of high stability and low toxicity,<sup>4,5,6,7</sup> and bearing in mind the fact that the amidine systems of themselves have shown high anti-malarial activity,<sup>8</sup> it was thought of interest to synthesise and study the pharmacological action of the substituted hydrazodicarbonamidines.

Accordingly, compounds of the types A and B have been synthesised, by reacting the respective cyanamides, prepared by a modification of Pierron method<sup>9</sup> with hydrazine sulphate, hydrazine hydrate and phenyl hydrazine, in equimolecular proportions in pyridine medium and refluxing over a small flame for 8-10 hours. The compounds in Table I were isolated as

TABLE I



S. No.	R	M.P. ° C. (Uncorrected)
1	-C <sub>6</sub> H <sub>5</sub>	225
2	-p-Cl.C <sub>6</sub> H <sub>4</sub>	183-84
3	-p-Br.C <sub>6</sub> H <sub>4</sub>	113
4	-p-I.C <sub>6</sub> H <sub>4</sub>	207
5	-o-CH <sub>3</sub> .C <sub>6</sub> H <sub>4</sub>	204
6	-p-CH <sub>3</sub> .C <sub>6</sub> H <sub>4</sub>	177
7	-p-OC <sub>2</sub> H <sub>5</sub> .C <sub>6</sub> H <sub>4</sub>	244 d.
8	-m-NO <sub>2</sub> .C <sub>6</sub> H <sub>4</sub>	288
9	-p-NO <sub>2</sub> .C <sub>6</sub> H <sub>4</sub>	218
10	-(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub>	191-192

their sulphates and were recrystallised from water and those in Table II were isolated as

TABLE II



S. No.	R	R'	M.P. ° C. (Uncorrected)
1	-p-Br.C <sub>6</sub> H <sub>4</sub>	-C <sub>6</sub> H <sub>5</sub>	151
2	-p-Br.C <sub>6</sub> H <sub>4</sub>	-C.NH.R	175 d.
		$\parallel$ NH	
3	-p-I.C <sub>6</sub> H <sub>4</sub>	-C.NH.R	218
		$\parallel$ NH	

their free bases and were recrystallised from water

The compounds are awaiting pharmacological investigations as possible anti-malarials and full particulars of the present work will be published elsewhere. The authors' thanks are due to Dr. B. H. Iyer for his keen interest in the work.

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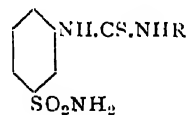
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### METANILAMIDE SUBSTITUTED THIOUREA DERIVATIVES

SIMPLE as well as substituted thioureas are known to possess chemotherapeutic properties, like anti-bacterial,<sup>1</sup> anti-mycotic,<sup>1</sup> anti-thyroid<sup>2</sup> and anti-tubercular<sup>1,3,4</sup> activities. Considering the anti-malarial<sup>5,6</sup> and anti-bacterial<sup>7</sup> properties of metanilamide and its derivatives and bearing in mind the chemotherapeutic properties of thioureas, it was thought worthwhile to

TABLE I

No.	R	M.P.
1	H-	164 to 160.5°
2	C <sub>6</sub> H <sub>5</sub> -	161.5°
3	p-Cl.C <sub>6</sub> H <sub>4</sub> -	162.5 to 163°
4	m-Cl.C <sub>6</sub> H <sub>4</sub> -	181 to 182°
5	p-Br.C <sub>6</sub> H <sub>4</sub> -	168.5°
6	p-I.C <sub>6</sub> H <sub>4</sub> -	180°
7	p-CH <sub>3</sub> .C <sub>6</sub> H <sub>4</sub> -	160.5 to 161
8	p-CH <sub>3</sub> O.C <sub>6</sub> H <sub>4</sub> -	155.5 to 156°
9	p-(CH <sub>3</sub> ) <sub>2</sub> C <sub>6</sub> H <sub>3</sub> -	153.5 to 157°
10	m (CH <sub>3</sub> ) <sub>2</sub> C <sub>6</sub> H <sub>3</sub> -	155 to 155.5°
11	α-C <sub>10</sub> H <sub>7</sub> -	170°
12	CH <sub>2</sub> =CH.CH <sub>2</sub> -	142 to 143°
13	CH <sub>3</sub> -	156.5 to 157°
14	(CH <sub>3</sub> ) <sub>2</sub> CH-	154°



synthesise a series of alkyl and aryl substituted thiocarbamido derivatives in the N<sup>3</sup>-position of metanilamide (Table I) for studying their chemotherapeutic properties.

Accordingly, the compounds tabulated below have been prepared by reacting a solution of the corresponding isothiocyanate in alcohol with a warm alcoholic solution of metanilamide, keeping the reaction mixture for 12 to 24 hours at laboratory temperature, filtering the solid, washing with cold alcohol and recrystallising the product from alcohol or dilute acetone.

Full details of the methods of preparation and pharmacological data will be published elsewhere.

Our thanks are due to Dr. B. H. Iyer for his keen interest in this piece of work.

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#### PHOTOPERIODISM IN SUNNHEMP C12 *CROTALARIA JUNCIA L.*

APART from yielding a good quality fibre Sunnhemp (*Crotalaria juncea L.*) is believed to enrich the soil in nitrogenous compounds, for which it is sometimes used as green manure to improve poor paddy lands. An investigation of the flowering behaviour of the plant with reference to the daily light period was undertaken. Singh, Kapoor and Choudri,<sup>1</sup> and Singh and Choudri<sup>2</sup> noted that the plant thrives best in 12 hours light period.

Sunn hemp C12 grows best in Calcutta when sown in May-June. Seeds obtained through the courtesy of the West Bengal State Agriculture Department were sown on 21-5-1951 in earthenware pots. Treatment was started four days later just after the cotyledons had unfolded. There were 5 treatments at 8, 10, 12, 14 and 16 hours of light per day. For light periods shorter than the normal day length, the pots were removed to a ventilated dark chamber at appropriate times and allowed to remain there until dusk. The additional light periods were supplied from a 100 C.P. electric bulb at a distance

of 1 meter, in case of longer light period treatments. Controls were maintained under natural conditions.

The following results were obtained and are given in a table expressing the mean of the readings for 12 plants per treatment. Flowering time is the time taken for the initiation of the first visible flower-bud, and the fruiting time, the appearance of the first visible fruit. In addition, the total height of the plant and the circumference at the base of the stem on the flowering day were noted separately for each plant.

Treatment	Mean height at flowering in cm.	Mean flowering time in days	Mean fruiting time in days	Basal cir- cumference (mean) of stem in cm.
8 hrs.	52.26	73	83	0.9
10 hrs.	45.84	37	48	0.9
12 hrs.	35.3	23	45	1.3
14 hrs.	254.1	131	143	6.3
16 hrs.	153.76 (On 13th Decem- ber, i.e., after 202 days)	No flowering	..	3.0
Control	216	109	125	5.95

It is thus found that Sunnhemp C12 is a short-day plant, flowering early under 12 hr. and 10 hr. Light periods longer than 12 hr. produce a prolonged vegetative phase. Under 16 hr. however, growth was rather poor and the plants continued to be vegetative till the middle of December when they dried up. The daily light period of nature for the controls gradually increased from 13 hr. 20 min. on May 25th to 13 hr. 31 min. on June 22 and again fell gradually to 12 hr. 3 min. at the time of flowering.

The author's thanks are due to Dr. J. C. Sen Gupta for his interest in the work.

Botanical Laboratory, SUMITRA TALUKDAR.  
Presidency College,  
Calcutta,  
July 7, 1952.

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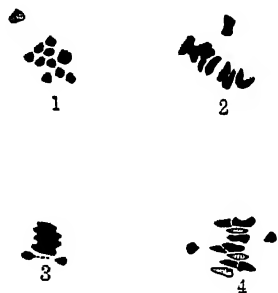
#### CHROMOSOME BASIS OF DIOECISM IN *TRICHOSANTHES DIOICA ROXB.*

*Trichosanthes dioica* Roxb., commonly known as *Parwal*, is extensively cultivated as a vegetable crop in Bihar and adjoining States. The sexes,

in this species, are on separate individuals, i.e., some individuals will be male, bearing only staminate flowers, whereas other individuals female, bearing only pistillate flowers. Thus this is a typical dioecious species.

Banerji and Das<sup>1</sup> studied the development of microspore in this species. They could not find any evidence as to the presence of sex chromosomes in mitotic as well as meiotic divisions. They reported somatic chromosome number as  $2n = 22$  in both male and female plants.

The meiotic studies reveal that at I metaphase, eleven bivalents are clearly seen (Figs. 1 & 2). In a large number of pollen mother-cells, one of the bivalents was seen lying away from the rest of the bivalents (Figs. 1 & 2) and was in a different plane. It also took a deeper stain. Of the other ten bivalents which tend to remain in a group, one bivalent was the biggest of the lot, also taking a deeper stain (Fig. 1).



FIGS. 1 to 4. Meiosis in *Trichosanthes dioeca*.—Fig. 1. I Metaphase (polar view), showing eleven bivalents, of which one is seen lying away from the rest, in a different focus. Note that one of the bivalents, lying in the group is the biggest,  $\times 1500$ . Fig. 2. I Metaphase (slanting view), showing eleven bivalents, of which one is seen lying away from the rest,  $\times 1500$ . Fig. 3. I Anaphase (early), showing the early separation of one of the bivalents,  $\times 1500$ . Fig. 4. I Anaphase, showing that one of the bivalents has separated earlier,  $\times 1500$ .

Anaphase stages (Figs. 3 & 4), clearly indicate that one of the pairs pulls apart earlier and the chromosomes move much ahead than in the case of the rest of the bivalents. It seems from the critical examination of the anaphase that the heteromorphic chromosomes which commonly indicate the presence of sex chromosomes are absent; however, the unusual behaviour of one pair of chromosome at I metaphase and I anaphase strongly suggests that this pair, in spite of having morphologically identical chromosomes, is physiologically different from the rest of the bivalents and presumably possesses sex determining genes.

Of the other species of *Tricosanthes*, worked out cytologically, viz., *T. anguina* (Banerji and Das<sup>1</sup>), *T. japonica* (Sinoto<sup>3</sup>) and *T. cucumeroides* (Yamaha<sup>4</sup> & S.), quoted from Darlington and Janaki Ammal,<sup>2</sup> the presence of sex pair of XY type has been reported in *T. japonica* only.

My sincere thanks to Dr. R. H. Richharia, Economic Botanist to Government of Bihar, for helpful discussions during the course of this study as well as for giving necessary facilities to work.

Botanical Section,  
Sabour,  
August 12, 1952.

G. I. PATEL.

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#### FOOD PLANTS OF THE DESERT LOCUST

WITH reference to earlier reports<sup>1,2,3</sup> on the food plants of the desert locust, experiments conducted by the present writer both under field conditions and in the laboratory show that the following is their order of preference in regard to plants as food material: (i) paddy, bajra and juar, (ii) mango (*Mangifera indica*), (iii) neem (*Melia azadirachta*), (iv) jamun (*Eugenia jambolana*), and shesham (*Dalbergia sisso*). The locusts do not feed on anjeer (*Ficus carica*), and sharifa (*Anona* sp.). It would thus appear that the desert locusts might in course of time become a serious threat to mango plantation in India.

The locusts under observations belonged to both sexes. The females were put in cages with different grades of hardness in soil. This experiment revealed that forced egg-laying is not a remote possibility in locusts under adverse conditions. Clusters of eggs were found on the food plants, as well as on the surface of soil if the latter is impenetrable for the ovipositor.

Entomology Section, S. MASHOOD ALAM.  
Zoology Dept.,  
Muslim University,  
Aligarh,  
August 28, 1952.

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## VEGETABLE EXTRACTS AND MALE TOAD REACTION

JAMES T. BRADBURY<sup>1</sup> has produced ovulation in rabbits by injecting various plant juices like those of oats, corn, alfalfa, carrot-top and lawn-grass cuttings. Similarly, we were able to produce emission of sperms by the toad *Bufo melanostictus* by injecting various vegetable extracts.

The vegetable product was ground with distilled water and filtered through ordinary filter-paper. The clear fluid thus obtained was injected into male toads whose cloacal fluids were examined and found negative for sperms. The injections were done subcutaneously with an initial dose of 10 c.c. followed by two injections of 5 c.c. each after an interval of 30 to 45 minutes or even more sometimes.

Extracts of lawn-grass (*Cynodon dactylon*), carrot leaves, alfalfa (grown at Bangalore) skinned, soaked Bengal gram seeds, cabbage leaves and paddy straw produced emission of sperms in the male toad. Paddy straw and cabbage leaves produced positive reaction only when injected fresh. We used 100 grams of vegetable product with 100 c.c. of distilled water. If the vegetable product is fresh and juicy, the extract will be concentrated. If it is dry, the extract will be diluted. In our experience we found that vegetable extracts are to be used only in dilute conditions. Even then alfalfa and carrot-top were toxic in higher doses. Of these, we were able to inject only 10 c.c. and that too, often in split doses of two or three c.c.'s each with a few minutes' interval. With 10 c.c. we were able to get positive reactions.

Wheat bran, rice bran, Bengal gram husk and bone-meal (not a vegetable product) also produced positive reaction in the male toad. They were left in the frigidaire overnight, each 100 grams with enough distilled water to soak through and get filtered. The next morning the fluid was filtered, and injected into toads to get positive reaction.

Whatever be the active principle in these extracts and bone-meal that is able to evoke the male toad reaction, it is very peculiar in not being destroyed while passing through the digestive tracts of various farm animals and laboratory animals like guinea-pig. We fed a non-pregnant female and a male guinea-pig with different diets consisting exclusively of cabbage leaves, lawn-grass (*Cynodon dactylon*), soaked skinned Bengal gram seeds and alfalfa. We collected the faeces the next morning and with the faecal extracts we were able to pro-

duce emission of sperms in the male toad. The dung of breeding bulls fed on alfalfa and other feeds and the dung of bullocks fed on paddy straw produced positive reaction in male toads. Dung of buffaloes—pregnant and non-pregnant, dung of cows—pregnant and non-pregnant, dung of asses—pregnant and non-pregnant and jack-ass, dung of jutka ponies—male and female and faeces of ram, all produced positive male toad reaction when the animals were fed mostly with grass. Hence we have to conclude that the reaction of the faeces of various animals is the same as the reaction of the food the animal eats.

Recently, Bhaduri<sup>2</sup> has suggested the use of faecal extracts for diagnosing pregnancy in farm animals. His claims were that a positive reaction in the male toad proved the pregnancy of the animal. More recently Krishna Rao and Krishnamurthy<sup>3</sup> failed to get the same results. They found that faecal extracts of pregnant cows, non-pregnant cows, sterile cows, bullocks, she-buffaloes and he-buffaloes, all produced positive results. Our findings clearly indicate that the positive result is due to the food the animal eats.

Faeces of a ram and a bull even after boiling with distilled water, when filtered and injected, produced positive reaction in the male toad. The active principle therefore, seems to withstand heat.

Further details will be published elsewhere.

Grateful thanks are due to the Principal and the Staff of the Animal Husbandry, Chemistry, Bacteriology and Biology Departments of the Madras Veterinary College for their valuable help.

Dept. of Biology,  
Madras Veterinary College,  
Madras,  
September 9, 1952.

MRS. K. HARRIS.

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## SOME NEW BACTERIAL DISEASES OF PLANTS

BACTERIAL diseases produced by three new organisms are described in this note:

(1) *Xanthomonas melhusi* nov. sp., Patel, Kulkarni and Dhande. The pathogen produces numerous, angular (quadrilateral), water-soaked translucent spots measuring 0.5 to 1 mm. On drying, the spots become brown to

deep brown and raised on the upper surface due to accumulation of bacterial ooze. Several spots coalesce to form large lesions.

*Description of the Pathogen.*—Short rods measuring  $2.1 \times 1.08 \mu$ ; gram negative; no spores; capsulated; on potato dextrose agar plates, the colonies are pulvinate, circular with entire margins measuring 1.5 cm. in diameter after 10 days, colour empire yellow (R) with no striations; gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; ammonia and hydrogen sulphide produced; acid but no gas from dextrose, sucrose and lactose; no growth in salicin; optimum temperature for growth about  $28^\circ\text{C}$ ., thermal death point near  $51^\circ\text{C}$ .; pathogenic to *Tectona grandis*; observed at Ambernath (Bombay State) in October, 1950.

(2) *Xanthomonas erythrinae* sp. nov., Patel, Kulkarni and Thirumalachar.

On the leaf, the pathogen produces numerous, angular, water-soaked specks which later become brown in colour and are surrounded by a halo which measure 0.5 to 1.0 mm. The spots are raised in the centre on the under surface of leaves and are flat on the upper surface. The veins are infected and appear in some cases to be raised on the upper surface. Infection is more towards the leaf-edges. As a result of severe infection, the leaflet becomes chlorotic.

*Description of the Pathogen.*—Short rods measuring  $1.6 \times 1.1 \mu$ ; gram negative; no spores; capsulated; on potato dextrose agar, the colonies are pulvinate, round, glistening, butyrous, with no striations and entire margins, 1.6 cm. in diameter after 10 days, colour lemon chrome (R); gelatin liquefied; starch digested; casein hydrolysed; milk peptonised; litmus reduced; ammonia and hydrogen sulphide produced; acid but no gas from dextrose, sucrose and lactose; no growth in salicin; optimum temperature for growth  $28^\circ\text{C}$ ., thermal death point near  $51^\circ\text{C}$ ., pathogenic to *Erythrina indica*; noticed at Patna (Bihar) in November, 1951.

(3) *Xanthomonas trichodesmæ* sp. nov., Patel and Kulkarni.

The pathogen produces small, round, water-soaked spots all over the leaf. Later on, these enlarge in size and measure 0.5 to 1 mm. in diameter. They are jet black in colour and raised on the upper surface, the corresponding area on the lower surface of leaves becoming depressed. Veins are often infected. Bacterial ooze in the form of shining scales is found on the spots on the lower surface.

*Description of the Pathogen.*—Short rods:  $2.2 \times 1.3 \mu$ ; gram negative; no spores; capsulated; on potato dextrose agar plates the colonies are pulvinate, circular with entire margins and measuring 1.9 cm. in diameter after 10 days with striations starting from the centre to the periphery; colour amber yellow (R); gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; ammonia and hydrogen sulphide produced; acid but no gas from dextrose, sucrose and lactose, no growth in salicin; optimum temperature for growth about  $28^\circ\text{C}$ ., thermal death point near  $50^\circ\text{C}$ ., pathogenic to *Trichodesma zeylanicum*; noticed at Chittlenagar, District Sholapur, in November, 1951.

Detailed account will be published elsewhere.

Plant Pathological Lab.,	M. K. PATEL.
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Poona-5,	G. W. DHANDE.

September 19, 1952.

#### BACTERIAL LEAF-SPOT OF *AMARANTHUS VIRIDIS* L.

A BACTERIAL leaf-spot of *Amaranthus viridis* was prevalent in Poona in February, 1952. Minute, round (0.5 mm. in diameter) water-soaked spots surrounded by a halo are formed along the edges of the leaf. These later become dark brown and depressed. The spots often coalesce to form irregular lesions measuring 1.5 to 2 mm. Bacterial ooze may be found in the centre of the spots. Infection spreads to the petiole and tender portions of the stem.

The organism is rod-shaped,  $1.3 - 2.1 \times 0.6 - 1.3 \mu$ , rounded at both ends, gram negative, capsulated, non-acid fast, single polar flagellate; stains readily with common dyes.

On potato dextrose agar plates, colonies are smooth, shining with entire margins, colour Empire yellow (R), 1.5 cm. in diameter in 7 days. On nutrient agar plates, colonies round, slightly raised, colour primuline yellow (R), diameter 10 mm. in 7 days; milk peptonised; litmus reduced; gelatin liquefied; starch hydrolysed; casein and egg albumen digested; cellulose not utilised; produces acid but no gas in dextrose, galactose, lactose, maltose, sucrose, mannitol and glycerol; salicin not utilised; ammonia and hydrogen sulphide produced; sodium chloride tolerant upto 3 per cent.; Loeffler's blood serum liquefied; nitrates not reduced; no growth in Cohn's and Uschinsky's solutions; fair growth in Koser's uric acid and Simmon's citrate media, best growth at  $28^\circ\text{C}$ .; thermal death point  $51^\circ\text{C}$ .



Pathogenic on leaves, petioles and stems of *A. viridis*. Since the pathogen differs from that described by Smith<sup>1</sup> on *Amaranthus* sp., it is proposed to name the organism *Xanthomonas amaranthicola* sp. nov.

Detailed account will be published elsewhere.

Plant Pathological Lab., M. K. PATEL.  
College of Agriculture, B. N. WANKAR.  
Poona-5, Y. S. KULKARNI.  
September 30, 1952.

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### SELF-INCOMPATIBILITY IN PUMELO (*CITRUS MAXIMA* MERR.)

THE occurrence of self- or cross-incompatibility has been reported in many fruits. In genus *Citrus*, both types of incompatibility was found by Ikeda<sup>1</sup> and Nagai and Tanikawa.<sup>2</sup> Gardner, Bradford and Hooker<sup>3</sup> have mentioned the case of *Victoria pumelo* which ordinarily was seedless but produced seeds freely when pollinated by certain other citrus species. Torres<sup>4</sup> found that the pumelo varieties native to Thailand were self-incompatible.

The pumelo varieties grown in India are nowhere reported to be self- or cross-incompatible. The author, however, noticed the presence of self-incompatibility in Chakaiya pumelo growing at the Fruit Research Station, Saharanpur.

With a view to study the percentage of fruit setting and seed formation in self- and cross-pollinated flowers the following treatments were done on two trees of the variety Chakaiya:

1. Bagged for natural self-pollination.
2. Bagged and hand-selfed on the day of anthesis.
3. Emasculated, bagged and cross-pollinated by hand on the day of anthesis.
4. Left unbagged for open pollination.

It was found that no fruit setting took place in naturally selfed and hand-selfed flowers, whereas in cross-pollinated and unbagged flowers (open pollinated) the percentage of setting was 25 and 17.2 respectively. The average number of plump seeds obtained in treatment Nos. 3 and 4 was 79.7 and 63.5 respectively.

Fresh pollen grains of this variety when examined in aceto-carmin revealed viability of a very high order (Average 94.4%). The pistils too were perfect and fully functional, because when cross-pollinated, they produced fruits. Since self-pollination failed to set fruits in spite of the reproductive organs being fully

functional, the variety may, in all probability, be a self-incompatible one.

Fruit Research Station, J. P. NAURIYAL.  
Saharanpur, U.P.,  
October 20, 1952.

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### A GALL MIDGE (ITONIDIDAE: DIPTERA) PEST OF CASTOR IN INDIA

WHILE working on the insect pests of castor oil plant during 1943-46, a gall fly was noticed for the first time damaging male flowers and young capsules to the extent of 71.5 per cent. Mani<sup>1</sup> described this fly under the name of *Asphondylia ricini* from specimens sent from here. He appended the biological note on the species sent by the author. The fly has been noticed on castor every year doing considerable damage. The other fly known to be associated with this plant is *Camptomyia ricini* Felt. bred out from dried castor stems and bark at Coimbatore (Felt<sup>2</sup>); *Camptomyia* breeds in decaying vegetable matter.

The eggs of *A. ricini* have not so far been noticed. The young maggot is pale-coloured. The older instars are yellow-white and have chitinated mouth parts. The puparium is dark brown, motile, with a pair of spines at the anterior end. Pupation occurs in the capsule; the empty pupal case is seen stuck up in the emergence hole after escape of the fly. The female has an aciculate ovipositor nearly one-fourth length of the body when extruded.

The maggots attack both male flowers and tender capsules. The attack is first noticed in the field during September (when the crop flowers), the peak of infestation being in October-November. From January onwards the attack is on the decline. Male flowers when infested do not open. They remain non-functional and are later shed. One to four maggots are found in each infested capsule, each locule having sometimes more than one maggot. Feeding is done by scraping of the tissues resulting in a gall-like swelling at the seat of attack. The interior of the capsules becomes felty. Infested capsules drop off after the emergence of the fly. Mature capsules with the hard-shelled seed do not suffer any damage.

Observations were made during 1950-51 season on two varieties, viz., H.C. 1 (non-spiny) and H.C. 6 (spiny). The spiny variety showed less infestation, the average percentage of attack being 43.9 while the non-spiny variety has an average attack of 63.6%.

Two ectoparasites *Evanoides ricini* Rao and *Eurytoma* sp. have been found attacking the larval and pupal stages of the pest.

Grateful thanks are due to Dr. Mohd. Qadir-uddin Khan, Government Entomologist, for guidance and encouragement.

Entomological Laboratory, A. S. RAO.  
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October 20, 1952.

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#### AN ABNORMAL FEATURE IN THE LIFE-CYCLE OF *UROMYCES PROEMI- NENS* (DC) LEV. ON *EUPHORBIA HYPERICIFOLIA* L.

It is a common feature during the rainy season (July-October inclusive) at Agra (Northern India) to observe many plants of *Euphorbia hypericifolia* infected with *Uromyces proeminiens*. The rust is autoecious and macrocyclic on this plant and various stages can be observed either simultaneously or at different times during the year.

Careful study in the field and under controlled green-house conditions shows that plants first observed to be infected have pycnial and aëcial stages only. These occur on all leaves and are confined to the lower surfaces. The internodes are greatly elongated and the leaves stunted, slightly fleshy and yellow green in colour. Infected plants die much sooner than healthy plants.

Just after the appearance of primarily infected plants, others in the vicinity show scattered uredia and then telia. Later in the season some branches develop on secondarily infected plants which bear aëcia resembling those arising from primary infection. Plants artificially infected with urediospores also first develop uredia followed by telia. Later aëcia appear on certain new branches, some of which become transformed to witches' brooms.

Systemic dikaryotic mycelium was observed inside nodes, internodes and apical buds of plants showing primary aëcial infection. Similar mycelium was also noted in the midrib of the leaves of these plants and in pycnia. In all

cases pycnia developed into protoaëcia. Aëciospores were binucleate and in chains. Systemic dikaryotic mycelium has also been noted in the aëcial shoots of artificially infected plants. The internodes below the leaf inoculated with urediospores were also found to have binucleate mycelium. In this respect *Uromyces proeminiens* resembles *Cytospora olcæ*<sup>1</sup> in not having a haploid stage in its life-cycle.

The author wishes to express his grateful thanks to the late Prof. K. C. Mehta and Dr. S. Sinha for guiding the work and to Dr. R. K. S. Wood of the Imperial College, London, for correcting the manuscript.

Botany Department, S. C. GUPTA.  
Agra College, Agra,  
August 8, 1952.

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#### CYCLISATION OF ETHYL BENZOYL- ACETATE- AND BENZOYL ACETOAC- ETATE-ANILS USING ACETIC ANHYDRIDE AND SULPHURIC ACID

THE synthesis of 4-hydroxy 2-phenyl quinolines, cyclising ethyl benzoylacetate-anils by Conrad-Limpach<sup>1</sup> method, has not been found as successful as that of 4-hydroxy 2-methyl quinolines.<sup>2</sup> Shah and co-workers<sup>3</sup> have explored the Conrad-Limpach synthesis with the ethyl benzoylacetate-anils and have shown that two products are obtained on cyclisation of the anils; viz., 2-methyl 3-benzoyl and 2-phenyl 3-acetyl 4-hydroxy quinolines.

An attempt was therefore made to cyclise ethyl benzoyl acetoacetate-anils by the method,<sup>4</sup> using acetic anhydride and sulphuric acid. Contrary to expectation, only single product 4-hydroxy 2-phenyl quinoline was obtained. It is therefore evident that deacetylation of the anil should have taken place prior to cyclisation, in spite of the presence of strong acetylating agent—acetic anhydride. The method has met with success in cyclisation of ethyl benzoyl-acetate-anils giving 4-hydroxy 2-phenyl quinolines in good yields. Further work along these lines with other  $\beta$ -ketonic esters is also in progress. Full details will be published elsewhere.

M. T. B. College, B. P. BANGDIWALA.  
Surat, C. M. DESAI.  
November 7, 1952.

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THIAMINE, RIBOFLAVIN, NICOTINIC  
ACID AND VITAMIN C CONTENTS  
OF PALM GUR

IN continuation of an earlier note<sup>1</sup> studies on the retention of vitamins in samples of palm gur are reported here. Estimation of the four vitamins was carried out by chemical methods. Vitamin C was estimated by the titrimetric method<sup>2</sup> using 2:6-dichloro phenol-indophenol dye. Thiamine was estimated by the thiochrome method,<sup>3</sup> nicotinic acid by the cyanogen bromide method<sup>4</sup> and riboflavin by fluorimetric method.<sup>5</sup> The samples used in present study were palmyrah and date-palm variety.

TABLE I

Vit. C mg./100 g.	Thiamine $\mu$ g./100 g.	Riboflavin $\mu$ g./100 g.	Nicotinic acid mg./100 g.
Palmyrah variety			
27.2	21.6	429	3.98
12.0	10.7	379	3.85
27.5	19.5	461	3.13
14.5	26.2	394	4.68
11.1	29.9	448	3.61
30.3	23.9	454	5.12
14.4	25.9	434	5.12
7.3	20.9	386	4.08
25.8	15.5	494	4.83
11.2	14.9	490	4.28
25.4	14.2	482	4.06
16.8	20.7	353	3.58
9.4	20.6	380	4.05
25.9	19.0	304	3.58
33.0	24.1	414	4.68
Date-palm variety			
5.0	18.5	438	4.41
5.2	21.1	429	4.50
14.4	18.2	490	4.06
30.0	29.6	433	4.09
26.6	26.5	448	3.98
28.1	22.6	420	3.92

The table indicates that the two varieties do not differ much in their vitamin contents. Thiamine, riboflavin and vitamin C are known to be very sensitive to high temperature and alkaline pH and it is surprising to find that these are fully retained in the samples of palm gur in spite of the method used for their manufacture (namely heating in an open pan at an alkaline pH and at 110-20°). Of the possible protective factors which stabilize the three vitamins, sulphhydryl compounds, which have been shown to prevent oxidation of vitamin C<sup>6</sup> in Neera were found to be absent in palm gur samples. Other substances known as 'apparent vitamin C' which reduce the dye have been shown to be present in walnuts, malt-extract, molasses and certain fruit juices.<sup>7,8</sup> The esti-

mation of the so-called apparent vitamin C in palm gur samples was, therefore, carried out by two methods.

1. *Formaldehyde method*<sup>9</sup>: The method consists in estimating first total vitamin C by normal titration with the dye. The true vitamin C is then destroyed by six-minute treatment with 6% formaldehyde at pH 4 to 5 and apparent vitamin C estimated. The difference between two results give true vitamin C.

2. *Use of ascorbic acid oxidase*<sup>10</sup>: The source of enzyme used was coriander leaves extract. The enzyme acts on true vitamin C to convert it into dehydroascorbic acid which does not reduce the dye. Hence the gur solution is treated with boiled coriander leaves extract and titrated after 2 hours to determine total vitamin C. The part of gur solution is treated with unboiled coriander leaves extract and titrated after 2 hours to determine apparent vitamin C. The difference between two results gives true vitamin C. The two methods gave very similar results. It has been found that nearly 40 to 50% of the total vitamin C is present in the form of apparent vitamin C. The nature of apparent vitamin C has not been proved as yet. Further work to study its nature is in progress.

The two varieties of palm gur samples were obtained from the various centres of their manufacture through the courtesy of the Palm Gur Adviser, Ministry of Food and Agriculture, Government of India, New Delhi.

Dept. of Biochemistry, B. V. HATWALNE.  
Institute of Science, KAMALA SOHONIE.  
Bombay,  
September 23, 1952.

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FORMYLATION OF SOME  
HYDROXYCOUMARIN DERIVATIVES

THE introduction of a formyl group in coumarins by the Gattermann reaction has been found to be unsuccessful.<sup>1</sup> Späth and Pailer,<sup>2</sup> however, were able to formylate 7-hydroxycoumarin by Duff and Bills method<sup>3</sup> using hexamethylene-tetramine and obtained 8-aldehydocoumarin in

poor yields. Later Rangaswami and Seshadri<sup>4</sup> prepared 7-hydroxy-4-methyl-8-aldehydocoumarin by the same method. Sen and Chakravarti<sup>5</sup> applied the Reimer-Tiemann method to coumarin for the synthesis of 6-aldehydocoumarin.

As the formylcoumarins would be important as starting materials for the synthesis of a number of heterocyclic compounds like furanocoumarins, coumarino- $\alpha$ -pyrones, it was thought of interest to extend the application of Duff and Bill method<sup>3</sup> to other hydroxycoumarins.

Now 5-hydroxy-4-methylcoumarin, 5-hydroxy-4:7-dimethylcoumarin, 6-hydroxy-4-methylcoumarin and 7:8-dihydroxy-4-methylcoumarin have been successfully formylated by slightly modifying the method of Späth and Pailer.<sup>2</sup> The compounds obtained are presumed to be the *ortho*-hydroxyaldehydes as they gave coloration with alcoholic ferric chloride and have been provisionally assigned the constitutions, 5-hydroxy-4-methyl-6-formylcoumarin, 5-hydroxy-4:7-dimethyl-6-formylcoumarin, 6-hydroxy-4-methyl-5-formylcoumarin, and 7:8-dihydroxy-4-methyl-6-formylcoumarin respectively taking into consideration the general reactivity of these coumarins. The detailed report will shortly be published elsewhere.

The work is being extended to other hydroxycoumarins and chromones. Application of other methods of formylation to coumarins is also being investigated.

The authors wish to express their thanks to Dr. R. C. Shah, for his keen interest in the work.

Organic Chemistry Labs., R. M. NAIK.  
The Institute of Science, V. M. THAKOR.  
Bombay,  
October 7, 1952.

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**CERCIAPHIS EMBLICA SP. NOV.**  
(FAM. APHIDIDÆ) A NEW APHID  
PEST ON *EMBLICA OFFICINALIS*

GENUS *Setaphis* v. d. Goot (Fam. Aphididæ) is characterized by the presence of a pair of long setæ on abdomen, media once branched and short cornicles. According to the Director, Commonwealth Bureau of Entomology, London, *Setaphis* is preoccupied and hence its species

should be referred to *Cerciaphis* which had been sunk in the past. A new species of the genus has been collected by us and is herein described briefly. Its complete description is however to be published elsewhere.

*Cerciaphis emblica* sp. nov. Alate viviparous female: Average length 1.367  $\pm$  .022 mm. Head flat between bases of antennæ, with antennal bases 0.164 mm. apart. Rostrum: reaching third coxæ. Antennal segments: Average lengths of first 0.0543, second .0635, third .345, fourth .176 mm., base of fifth 0.155 and flagellum .082 mm. long. Fourth segment with 14-16 circular sensoria and fifth with 1-2 sensoria. Thorax: citrine, drab in fresh specimens and little lighter than head. Legs: femur, apices of tibia and tarsi dark. Average lengths of fore, mid and hind tibiæ 0.509, 0.478, and 0.599 mm. respectively. Fore wings: Average length 2.006 mm. stigma dark, cubitus (or media of American authors) once branched with bands along veins giving smoky appearance. Hind wings: reduced average length 0.430 mm. Anterior margin with a dark band along a feeble vein. Abdomen: malachite green, with short cone-shaped, striate cornicles which are armed with two very small bristles. Abdomen just above cauda provided with a pair of long setæ measuring 0.186 mm. projecting beyond cauda and with short bristle. Cauda not distinct, rounded and with some long bristles.

Apterous viviparous female: Average length 1.514 mm. pale green. Head: Almost flat between bases of antennæ which are 0.171 mm. apart; frontal tubercle almost absent. Eyes: made up of three facets. Rostrum: Average length 0.388 mm. dark apically and reaching third coxæ. Antennæ: Average length of segments in mm. first 0.06, second .051, third .357, fourth 0.187, base of fifth 0.165 and flagellum 0.83. Fourth segment with one apical sensoria and fifth with one at the apex of the base. Legs pale except darker tarsæ, roughly imbricate. Average lengths of fore, mid and hind tibiæ 0.357, 0.419 and 0.451 mm. Abdomen: malachite green uniformly oval, but slightly swollen in region of the cornicles.

Host: Heavy infestation of leaves of *Emblica officinalis* which is cultivated for its vitamin C-rich fruits, have been observed at Poona and Anand.

Entomological Laboratory, G. A. PATEL.  
Dept. of Agriculture, H. L. KULKARNI.  
College of Agriculture,  
Poona-5,  
September 17, 1952.

## REVIEWS

**Quantum Theory of Matter.** By J. C. Slater. (Published by McGraw-Hill), 1951. Pp. xiv + 528.

This book is intended to be a companion volume to the other books by Prof. Slater and collaborators on "Mechanics", "Electromagnetism" and "Introduction to Chemical Physics". "All these together are expected to form a fairly complete treatment, on the intermediate level of difficulty, of most of theoretical physics, with the exception of nuclear theory." However, the book under review is in itself an independent unit and covers a definite field, namely, the fundamentals of quantum mechanics and its application to the physical properties of matter. Prof. Slater uses throughout the Schrödinger method of considering problems in quantum theory. The first chapter deals with the physical principles of De Broglie Waves and Wave Mechanics. The next three chapters contain a discussion of the Schrödinger equation and the general method of obtaining physical results from it. The rest of the book is concerned with the application of wave mechanics to spectroscopy, interatomic forces and chemical, mechanical, thermal, optical, magnetic and electrical properties of matter. A chapter is set apart for the theory of the metallic state.

As is to be expected of an author of the eminence of Prof. Slater, the book is written in a very lucid style, and will be readily intelligible even to a beginner in quantum theory. However, it is not elementary—the more difficult mathematical portions are included in a large number of appendices, covering nearly 80 pages. The book is eminently suitable for being used as a text-book in the M.Sc. classes of our Universities, and it is not too much to say that a thorough knowledge of its contents is a 'must' for every student who wishes to undertake research work in any branch of physics.

G. N. R.

**Structural Chemistry of Inorganic Compounds.** Vol. II. *Structure and Constitution.* By Walter Hückel. (Published by Elsevier, Distributors, Cleaver-Hume Press), 1951. Pp. x + 441-1094.

Except for the first and the last chapters, the bulk of the second volume is devoted to crystal chemistry, namely, the crystal structures of inorganic compounds, the structure and bonding

in silicates and glasses, and the lattice structure of metals and alloys. The usual books on crystal chemistry, are written from the crystallographer's point of view; but Prof. Hückel's treatment is different, inasmuch as it is based mainly on chemical considerations. He assumes a certain amount of background of crystallography, but this is not essential for following the thread of the argument. The idea of coordination forms the main basis, and the various types of structures are explained as arising from variations in valency and ionic radii. Then follows an account of polymorphism occurring in inorganic crystals and the phase theory of such modifications and also an atomic theory based on the crystal structure. The essential relationships between the different structures are illustrated by excellent diagrams which bring out only the necessary details, without encumbering them with superfluous data. In particular, the discussion of the various modifications of silica and of titanium dioxide is the clearest that the reviewer has come across. There is a section on mixed crystals and another on isomorphism and oriented overgrowths.

The chapter on silicates and glasses contains a short but excellent survey of the structures of silicate minerals. The diagram on p. 758 showing the correlation between the layer structures of talc, micas, chlorites and clay minerals is highly illuminative. The theory of the vitreous state occupies a prominent position in the section on glasses. Prof. Hückel is inclined to accept the network theory of glasses as correct, at least in the case of inorganic glasses.

The chapter on metals and alloys deals with a wide variety of chemical topics, such as the structures of metals, intermetallic phases and alloys, the phase diagrams of alloy systems, Hume Rothery's rule, magnetism of metals and alloys, and structures of non-stoichiometric metallic compounds, particularly oxides, nitrides and carbides.

The first chapter in the present volume contains an account of the properties of volatile inorganic compounds in relation to their molecular and crystal structures and the nature of the chemical bonds. The last chapter is concerned with the chemical reaction in inorganic chemistry, in particular, ionic reaction and reactions of solid substances. The book concludes with a brief account of the motivating forces which has led to the various developments in

chemical science and a short review of the present state of affairs.

Prof. Hückel has eminently succeeded in putting inorganic chemistry on a systematic basis, comparable to what is now obtaining in the field of organic chemistry. It is indeed a unique book, and it should be an invaluable addition to the library of every physical or chemical laboratory.

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Flora of the British Isles. By A. R. Clapham, T. G. Tutin and E. F. Warburg. (Cambridge University Press), 1952. Pp. 1591. Price 50 sh.

Floras written in classical style are always welcome in any country in the world no matter from where they originate. This is especially so for the University under-graduates and post-graduates and also their teachers, not to mention the amateur botanists whose needs are not so exacting. The book under review is an excellently produced treatise and is a worthy modernised successor to John Ray's *Catalogus Plantarum Angliæ et Insularum Adjacentium* (1670) and William Hudson's *Flora Anglica* (1762), the latter being the pioneer in introducing the binomial system of classification. Since then, Bentham's *Handbook of the British Flora* (1858) and Hooker's *Students' Flora of the British Islands* (1870) are the only two works that could be regarded as landmarks in progress of systematic botany of that country. The appearance of this book, therefore, would be received well in most countries, particularly in India where, despite the emphasis on many experimental aspects of botany in University curricula, there is an increasing appreciation of the need for stepping up of standards of imparting education in this field of science, and the authors of this book rightly point out "Taxonomy is now only one branch, though an important and indeed a fundamental branch of botany, and many people who are not primarily taxonomists have need to identify correctly".

The descriptions and keys in this book are precise and well edited and the authors have promised a volume of illustrations in due course which would be a very useful addition to this volume. The arrangement of families is similar to that adopted by Bentham and Hooker and great emphasis has been laid on the evolutionary tendencies in the plant kingdom; thus, the Pteridophyta find a place in the beginning of the book and the book ends with descriptions of Monocotyledones. Certain firm decisions have been taken by the authors in the matter of following the rather popular preference among

botanists nowadays in using the small initial letter instead of an initial capital letter when the epithet concerned is derived from a personal name or a noun. This is a move in the right direction. The authors have also judiciously used their discretion in splitting large heterogeneous genera into a number of reasonably homogeneous groups and further they have recognised subspecies where morphologically similar plants differed cytologically, ecologically or in details of geographical distribution.

The reviewer warmly commends this excellently got-up and authoritative Flora to all botanists in this country. T. S. SADASIVAN.

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The Action of Hormones in Plants and Invertebrates. Edited by K. V. Thimann. (The Academic Press Inc., New York), 1952. Pp. 228. Price \$5.80.

Ever since the discovery of Hormones in plants by Boysen-Jensen following critical growth movements by Charles and Francis Darwin, much water has flown under the bridge. The classical researches of Boysen-Jensen, Paal, Seubert and Went to mention a few, have added one more dynamic subject of research and study under the omnibus branch called Plant Physiology. Nevertheless, a comprehensive treatise dealing with all the knowledge that has accrued over many eventful years in this century both in the plant and animal cells has at last been attempted in this treatise. Much of the information as the Editor of this volume points out, was first printed in 1948 as a few chapters of 'The Hormones', Volume I and it has since been revised and expanded to its present size.

The contents of this book afford stimulating reading and it rightly presupposes a fundamental knowledge and interest in what might be called 'Functional Biology'. The three contributors of the chapters on 'Plant Growth and Other Hormones', 'Hormones in Insects' and 'Hormones in Crustaceans' have brought together all the latest research material available in these fields of enquiry and clearly this is the function of such treatises. The various techniques used in the study of these problems are very clearly written and the illustrations and general get-up of the volume are all that is to be desired. The references given are exhaustive, although on a minor point of citation of the names of journals, the authors have not always bestowed much attention in making them conform to conventional methods of abbreviation of titles of International journals. Altogether, this volume would be a most profitable reading to all biologists. T. S. SADASIVAN.

**A Hand-Book of Shellac Analysis.** By M. Rangaswamy and H. K. Sen. Second Edition. Revised by G. N. Bhattacharya and G. K. Bose. (Indian Lac Research Institute, Namkum, Bihar, India), 1952. Pp. x + 144. Price Rs. 4-8-0.

In bringing out this revised edition, ten years after the first one was published, special care has been taken to include recent information on all aspects of shellac analysis, in particular, the tentative Indian Standard Specifications of 1946 and the A.S.T.M. Standards of 1949 and 1950. Although a general reference has been given to these specifications in the preface, it would have been more appropriate to refer to the actual reference number of each specification when it is quoted in the different chapters. It will help this extensive compilation of standard methods of analysis to be more useful in quoting the original source of the test in each case.

The book is divided into 15 chapters, each chapter being devoted to one important test, which is discussed at some length in order to give the analyst an idea of its real importance. The methods of testing, including the description of apparatus required and the procedure are given in detail and very often in the original wording, in order to render a reference to the original as far as possible unnecessary. These chapters are followed by an appendix of specifications for different grades of lac and shellac varnish, which will be of great assistance to the dealer, purchaser and analyst.

The book is, on the whole, neatly got up with clear diagrams and with very few printing mistakes and is moderately priced. On page 21 in Fig. 4, the container for the extraction cartridge is wrongly indicated as the siphon tube. On page 53, a sketch of the apparatus described for the estimation of orpiment could have been given.

P. B. J.

**Soil Chemistry.** By M. W. Shawarbi. (Chapman & Hall Ltd., Essex Street, W.C. 2), 1952. Price 32 sh. nett.

A book on soils, particularly its chemistry, would appear to the layman a most uninteresting subject in spite of the repeated focussing in recent times of public attention on soils as the provider of the wherewithal for life of practically every living being on this earth. Dr. Shawarbi's book is an exception and is highly interesting. In his preface he very aptly summarises this idea by stating that "The soil is the cradle and burial place of all life".

The book deals in a very interesting manner with all aspects of soil chemistry, and contains twenty-six chapters covering over 418 pages. Dr. Shawarbi has drawn frankly from his own experience in the United Kingdom and in Egypt examples to illustrate the several processes explained. A very good description of the chemical and biochemical processes introduces the subject, and is followed by an account of the role of colloid complex in soils, of minor elements, soluble matter in soils and soil solution, soil acidity and time practice, reclamation of alkaline lands, soil formation and soil classification. Finally, there are chapters on aspects of soil fertility, soil conservation, soils and agriculture. A special chapter on the literature of soil chemistry and its use is given to aid the student in his studies. A very selected bibliography and a good index are also included. The book is well planned and ably executed. Printed on good paper in a very attractive manner in a clear bold type it makes reading easy. However, it is very disappointing to find many printer's devils, due no doubt to poor proof reading. On the whole, it is an excellent book, which can be confidently recommended to every one interested in soils.

N. G. C.

**Dairying in India.** By J. N. Warner. Issued by the Indian Council of Agricultural Research, New Delhi. (Macmillan & Co., Ltd., Calcutta). 1951. Pp. xii + 380. Price Rs. 15.

The appearance of this manual fulfils a long-felt need for a handy text-book dealing with the principles and practice of scientific dairying against the Indian background, and it is bound to be welcomed by all dairy students, technicians and enlightened farmers in the country. The author has admirably compressed in one small manual a wealth of technical knowledge combined with practical information on the subject.

The opening chapter presents copious statistical data relating to cattle wealth and milk production in India, economic value of the cattle-dairy industry and related aspects. Unfortunately, much of the data lose their significance now since they were compiled in 1945 before the partition of the country.

In the course of the next 14 chapters the author has dealt with various topics under the following titles: Management of dairy cattle in health and disease, milk secretion, constituents of milk, nutritive value of milk, dairy chemistry, dairy bacteriology, dairy engineering, common dairy processes, manufacture of



various indigenous as well as Western types of dairy products, maintenance of production records, the economics of dairying and dairy book-keeping, marketing of milk and co-operative dairying and goats and other animals as milk producers. At the end of the book there are some useful appendices containing feeding schedules for different classes of farm animals, mathematical data for calculations, etc., followed by a bibliography and indices.

While the information provided in the book on most of the topics appears to be fairly comprehensive, one or two important aspects have not received as much attention as they deserve. For example, the subject of dairy bacteriology has been dealt with in a very sketchy and incomplete manner while some of the statements made are at variance with the trends of recent research. Again, in a manual of this kind, some detailed discussion about modern methods of milk distribution, organisation of the industry on co-operative lines, etc., in relation to Indian conditions would have been very appropriate as well as helpful. The inclusion of a glossary of technical terms used in the book would enable readers in understanding such terms as "Zebu", etc. The above are minor points only and do not in any way detract the value of the present manual as being a very instructive and useful guide to the student as well as the practical dairyman in the country. H. L.

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**Manual of Bacterial Plant Pathogens. Second Edition.** By Charlotte Elliott. (The Chronica Botanica Company, Waltham, Mass., U.S.A., Macmillan & Company, Calcutta), Price \$ 6.00.

This new edition of the *Manual* brings up to date all available information on the plant pathogenic bacteria. Part I of the book describes pathogens of proved validity and in Part II are listed species which have been reported in the literature as pathogens but whose pathogenic character has not been fully proved yet. Each plant pathogen in Part I is listed with its synonyms, its cultural, morphological, and physiological characters, the disease symptoms it produces, the geographical distribution of the disease, control measures, and important literature citations. Two indices, one for the pathogens and the other for the hosts, are also given. As it is, the book will prove valuable for ready reference to all working on the phytopathogenic bacteria.

In the preface, the author has said that "The nomenclature follows, largely, that of the 1948 edition of *Bergey's Manual*." In view of this statement, it appears surprising, therefore,

that the author has retained the binomial *Xanthomonas solanacearum* (E. F. S.) Dowson instead of *Pseudomonas solanacearum* (E. F. S.), the latter being the one appearing in *Bergey's Manual*, 1948. Dowson in 1943 [*Brit. Mycol. Soc. Trans.* 26 (1 & 2), 4-14] first included this pathogen in his new genus *Xanthomonas* but later shifted it to *Pseudomonas* in 1949 (Dowson: *Manual of Bacterial Plant Diseases*, Adam and Charles Black, London, 1949), as according to him it resembles *Pseudomonas* in morphological and cultural characters; this was already done in *Bergey's Manual* in 1948. Even if the author had intended following Dowson's nomenclature, *Pseudomonas solanacearum* should have been the proper name for the brown-rot organism, in view of the facts given above. This, however, is a matter of opinion and does in no way mar the usefulness of the book.

All citations to literature are prior to 1948; possibly some later papers were not available (notably *Indian Phytopathology* and *Current Science*) or the book was sent to press in 1948, as otherwise the author would have come across some recent work on bacterial plant pathogens, particularly by M. K. Patel from Poona.

The book is excellently printed and got up in the best traditions of the Chronica Botanica Company and should be a valuable addition to any plant pathological library. V. P. BHIDE.

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**The Indian Pharmacist, Glass Containers Special Number.** The July 1952 issue of the *Indian Pharmacist*, the official organ of Indian Pharmaceutical Congress Association, is a special number dealing with the problems of glass containers for various industries. The proceedings of a symposium organised by the Central Glass and Ceramic Research Institute about the suitability of glass containers made in India and also speeches made by several experts in this field were published in this particular issue of the journal.

The glass manufacturers have so far been interested in the shape of the article rather than quality which is extremely important for storing pharmaceutical preparations. Dr. Atma Ram has rightly stressed that some set standards should be laid down by the All-India Glass Manufacturers' Federation to ensure quality and uniformity of the products with the establishment of a full-fledged national laboratory devoted to the subject of glass, the opportunities offered by the institute should be fully availed of by the industry. There should be proper control on manufacturing operations and



each factory should equip itself with a technical person in order to exercise control and to keep proper data without which it would be difficult to make a proper appraisal of the manufacturing problems and even more difficult for the central institute to help them.

The industry is hampered by the high price of imported soda ash which is the chief raw material. The rebate on soda ash given to the glass industry has been recently withdrawn on the recommendations of Tariff Board. The cost on soda ash makes up a major portion of the expenditure on raw materials of the glass articles and the rebate on customs duty is absolutely essential in the interests of glass industry. This is a useful monograph containing a lot of information for people interested in the development of pharmaceutical, food and cosmetic industries.

B. K. B.

Proceedings of the Bihar Academy of Agricultural Sciences. Vol. I, No. 1. January, 1952. Price Rs. 3-8-0. Annual Subscription Rs. 10.

The Bihar Academy of Agricultural Sciences (Headqrs. at the Agricultural Research Institute, Sabour P.O., Bihar), is to be congratulated on the issue of the first number of its *Proceedings*, published in January, 1952. It is a handsome publication in an attractive orange-yellow cover, printed and published at the Bangalore Press. The *Proceedings* are to be published thrice a year, the annual subscription being Rs. 10.

The issue contains 7 papers, all of which are well written and of considerable scientific value. Four of them pertain to Agricultural Botany, of which one is about studies on the Inter-Varietal Hybridization in *Luffa acutangula*; another is on studies in respect of increasing fruit-yields in Papaya; the third, on 'Size and

Shape of Plots in Wheat Trials'; and the fourth concerns Cytological Studies in *Loranthus*. Entomology is represented by a paper on 'Studies in the Production of Carbon Dioxide in Stored Wheat Infested by Grain Weevils'. There are two articles on Soil Chemistry: one, on the 'Determination of Exchangeable Cations in Bihar Soils' and the other is a comprehensive paper based on surveys of Bihar Soils in respect of their manurial requirements. The paper is accompanied by several appendices, in which the results of various observations and experiments are tabulated. The work reported on would appear to be very useful and practical from the cultivator's point of view.

Y. R. R.

#### Books Received

*Theory of Electric Polarisation*. By C. T. F. Bottcher. (Elsevier Publishing Co.), (Distributors: Cleaver-Hume Press), 1952. Pp. xiii + 492. Price 70 sh.

*Electrochemical Data*. By B. E. Conway. (Elsevier Publishing Co.), (Distributors: Cleaver-Hume Press, London), 1952. Pp. xviii + 374. Price 55 sh.

*Anuvil Thandavam* (Tamil). By R. K. Viswanathan. (R. K. Viswanathan), 1952. Pp. 220. Price Rs. 3.

*Biochemical and Allied Research in India*, Vol. XXII for 1951. Published in 1952. Price Rs. 3.

*Colloid Science I*. By H. R. Kruyt. (Elsevier Publishing Co.), 1952. Pp. xx + 389. Price 70 sh.

*Data and Circuits*. By N. S. Markus and J. Otte. (Elsevier Publishing Co.), 1952. Pp. 11 + 487. Price Rs. 21.

*Major Faults on Power Systems*. By A. G. Lyle. (Chapman & Hall), 1952. Pp. xvi + 355. Price 45 sh. net.

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## SCIENCE NOTES AND NEWS

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### *Everyday Science*—Quarterly Journal of Popular Science

*Everyday Science*, Vol. 1, No. 1, of which has just now appeared, goes a long way in fulfilling the need for a journal devoted to the dissemination of scientific knowledge among non-specialists. Judging by the excellence of the contributions in it, the North India Science Association, who have sponsored it, deserve our heartiest congratulations. With an Editorial Board which includes such distinguished names as Prof. M. S. Randhawa, Sir S. S. Bhatnagar,

Dr. S. L. Hora and many others, we are sure that it will not be long before the journal makes its appearance as a monthly instead of a quarterly as at present.

### New Development in Polio Research

Dr. Cox, Director of Virus Research at the Lederle Laboratories, New York, reports that the Lansing type of Polio virus has been modified and caused to grow in chicken eggs. This method is much easier, less costly and it is hoped, will lead eventually to the production

of an effective immunising vaccine for polio. It is, however, stated that no vaccine is now available through this method, nor is it possible to say definitely whether such a vaccine might become a reality for use on human beings.

#### Titanium-Dioxide Rectifiers

A new type of rectifier recently developed by the National Bureau of Standards promises to be the first major improvement in metal-oxide rectifiers since their introduction in 1926. The new rectifier is composed of a layer of semi-conducting titanium dioxide, a sheet of titanium metal, and a counter-electrode of some other conducting metal. Preliminary investigations have shown that the units withstand voltage in the reverse direction reasonably well and that their properties are satisfactory at elevated temperatures. Both the initial development and subsequent detailed exploratory investigations are the work of R. G. Breckenridge and W. R. Hosler of the NBS Solid State Physics Laboratory.

#### Unimeter

The versatile forestry instrument *Unimeter* was designed and constructed towards the end of the last war to serve the needs of the army for rough and ready use in its varied activities. This simple, multi-purpose instrument may be used as a ghat tracer, abney level, hypsometer, altimeter, clinometer, cross staff, optical square, crown meter, sextant, all in one. Further details are available from Dr. K. Kadambi, Conservator of Forests, No. 3, Forest Research Institute, New Forest P.O., Dehra Dun (India).

#### J. M. Das Gupta Memorial Medal

Applications are invited for the above Gold Medal for 1952 from chemists of any age. The award will be made on unpublished researches and/or on independent papers published in the *Journal of the Indian Chemical Society* by the candidates during the years 1951 and 1952. No paper for which any other prize, or Degree

other than M.A., or M.Sc., has been obtained, will be accepted. Applications together with four copies of each reprint or typewritten paper should reach the Hon. Secretary, Indian Chemical Society, P.O. Box 10857, Calcutta, not later than 31st March, 1953.

#### UNESCO Guide to Importation of Scientific Materials

UNESCO has issued a 21-page pamphlet explaining the operation of the International agreement on the importation of educational, scientific and cultural materials. The price of the publication is 20 cents.

#### Award of Research Degree

The Punjab University has awarded the Degree of Doctor of Philosophy in Zoology, to Mr. Karam Singh for his thesis on "The Aleurodidæ (White Flies) of India and Burma".

#### Ramsay Centenary Exhibition

An exhibition, organised jointly by the Science Museum and University College, London, is being held from October 2 to January 3, 1953, to mark the centenary of the birth of Sir William Ramsay, C.B., F.R.S., and to commemorate, among other work, the discovery of the inert, or "rare" gases of the atmosphere—argon, helium, neon, krypton and xenon.

#### Foreign Students' Seminar at MIT

Four Indian students have been invited to attend the Foreign Students' Summer Seminar at the Massachusetts Institute of Technology, U.S.A., to be organised by the United States National Student Association Committee, between June 8 and September 25, 1953, for research in science, engineering, architecture and regional planning. The selected students will have to pay their own passage money both ways. Applications should reach the Ministry of Education, Government of India, New Delhi, on or before January 8, 1953.

### NOTICE

All material intended for publication in *Current Science*, corrected proofs, books for review and exchange journals, may please be sent to the Editor:

Professor G. N. Ramachandran,  
A. C. College of Technology,  
Guindy, Madras-25.

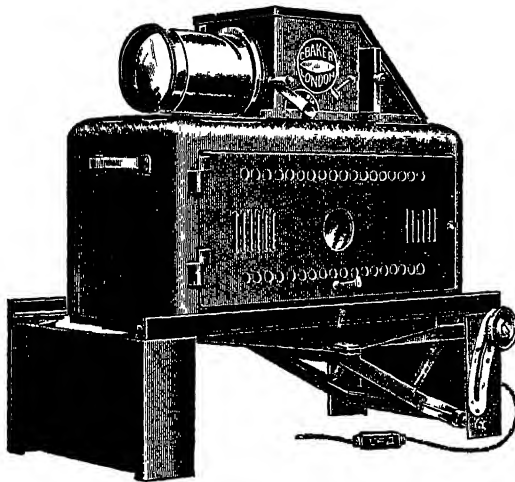
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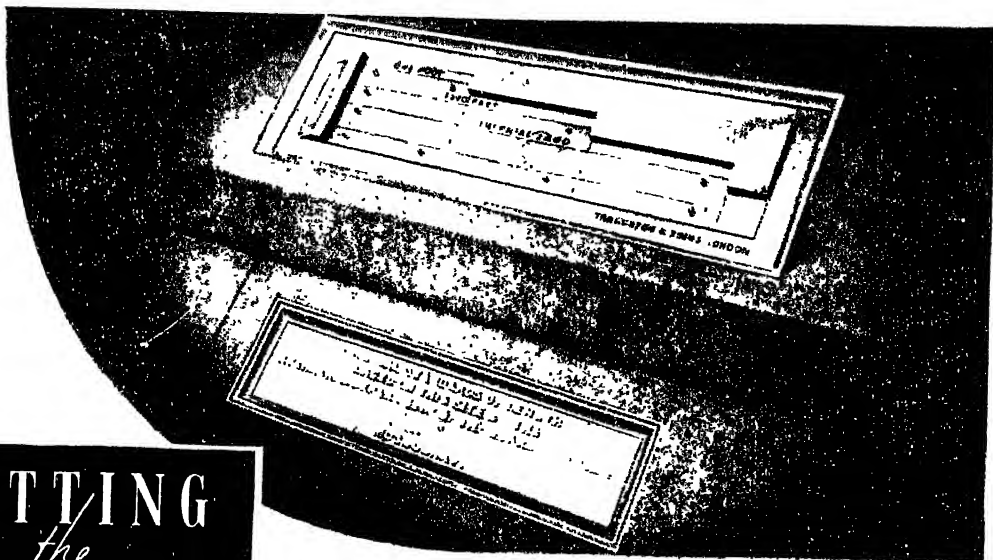
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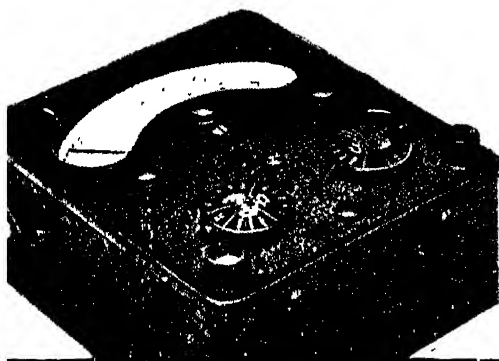
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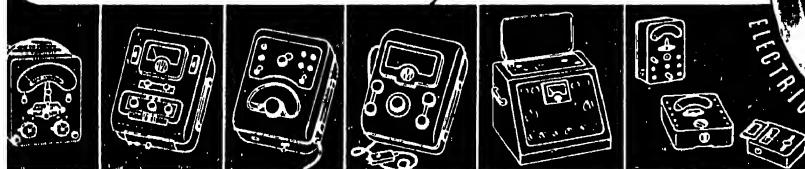


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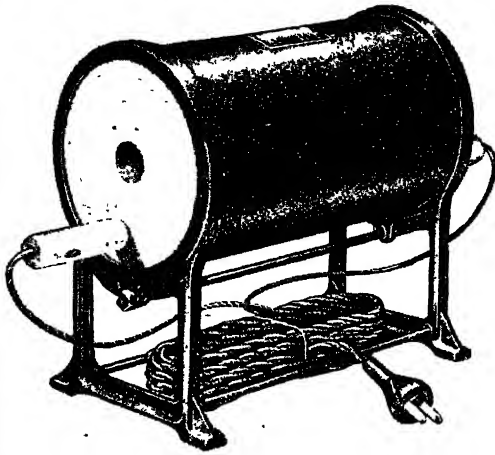
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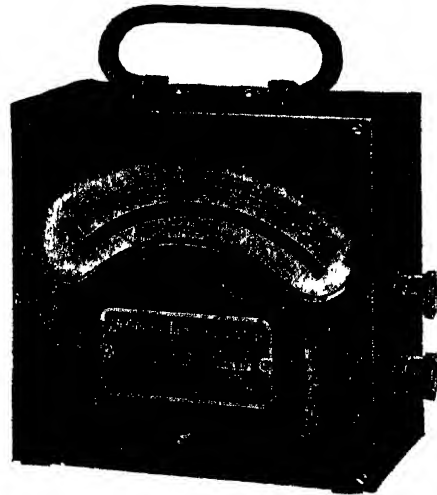
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